Supporting Information to "TropMol: A Cloud-based web tool to predict acetylcholinesterase inhibitors by machine learning"

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1 Tuning Parameters

Here are shown the tuning values used in the Random Forest, Gradient Boosting, XGBoost, and LightGBM models.

1.1 Random Forest

Testing different parameter combinations for RANDOM FOREST on the normalized dataset (with 15% test set)

```
param_grid_normalized = {
    'n_estimators': [10, 50, 100, 110, 150, 200, 500, 1000, 2000],
    'max_depth': [10, 15, 20, 25, 30, 35, 40],
    'min_samples_leaf': [1, 2, 4],
    'max_features': ['sqrt', 'log2']
}
```

Testing different parameter combinations on the normalized dataset:

R^2

R^2 with n_estimators=10, max_depth=10, min_samples_leaf=1, max_features=sqrt: 0.5583

R^2 with n_estimators=10, max_depth=10, min_samples_leaf=1, max_features=log2: 0.5413

R^2 with n_estimators=10, max_depth=10, min_samples_leaf=2, max_features=sqrt: 0.5385

R^2 with n_estimators=10, max_depth=10, min_samples_leaf=2, max_features=log2: 0.5276

R^2 with n_estimators=10, max_depth=10, min_samples_leaf=4, max_features=sqrt: 0.5371

R^2 with n_estimators=10, max_depth=10, min_samples_leaf=4, max_features=log2: 0.5282

R^2 with n_estimators=10, max_depth=15, min_samples_leaf=1, max_features=sqrt: 0.6897

R^2 with n_estimators=10, max_depth=15, min_samples_leaf=1, max_features=log2: 0.6809

R^2 with n_estimators=10, max_depth=15, min_samples_leaf=2, max_features=sqrt: 0.6715

R^2 with n_estimators=10, max_depth=15, min_samples_leaf=2, max_features=log2: 0.6635

R^2 with n_estimators=10, max_depth=15, min_samples_leaf=4, max_features=sqrt: 0.6404

R^2 with n_estimators=10, max_depth=15, min_samples_leaf=4, max_features=log2: 0.6371

R^2 with n_estimators=10, max_depth=20, min_samples_leaf=1, max_features=sqrt: 0.7276

R^2 with n_estimators=10, max_depth=20, min_samples_leaf=1, max_features=log2: 0.7249

R^2 with n_estimators=10, max_depth=20, min_samples_leaf=2, max_features=sqrt: 0.7072

R^2 with n_estimators=10, max_depth=20, min_samples_leaf=2, max_features=log2: 0.6985
R^2 with n_estimators=10, max_depth=20, min_samples_leaf=4, max_features=sqrt: 0.6843
R^2 with n_estimators=10, max_depth=20, min_samples_leaf=4, max_features=log2: 0.6747
R^2 with n_estimators=10, max_depth=25, min_samples_leaf=1, max_features=sqrt: 0.7243
R^2 with n_estimators=10, max_depth=25, min_samples_leaf=1, max_features=log2: 0.7257
R^2 with n_estimators=10, max_depth=25, min_samples_leaf=2, max_features=sqrt: 0.7173
R^2 with n_estimators=10, max_depth=25, min_samples_leaf=2, max_features=log2: 0.7052
R^2 with n_estimators=10, max_depth=25, min_samples_leaf=4, max_features=sqrt: 0.6872
R^2 with n_estimators=10, max_depth=25, min_samples_leaf=4, max_features=log2: 0.6723
R^2 with n_estimators=10, max_depth=30, min_samples_leaf=1, max_features=sqrt: 0.7146
R^2 with n_estimators=10, max_depth=30, min_samples_leaf=1, max_features=log2: 0.7170
R^2 with n_estimators=10, max_depth=30, min_samples_leaf=2, max_features=sqrt: 0.7053
R^2 with n_estimators=10, max_depth=30, min_samples_leaf=2, max_features=log2: 0.7103
R^2 with n_estimators=10, max_depth=30, min_samples_leaf=4, max_features=sqrt: 0.6848
R^2 with n_estimators=10, max_depth=30, min_samples_leaf=4, max_features=log2: 0.6626
R^2 with n_estimators=10, max_depth=35, min_samples_leaf=1, max_features=sqrt: 0.7316
R^2 with n_estimators=10, max_depth=35, min_samples_leaf=1, max_features=log2: 0.7233
R^2 with n_estimators=10, max_depth=35, min_samples_leaf=2, max_features=sqrt: 0.7123
R^2 with n_estimators=10, max_depth=35, min_samples_leaf=2, max_features=log2: 0.7169
R^2 with n_estimators=10, max_depth=35, min_samples_leaf=4, max_features=sqrt: 0.6863
R^2 with n_estimators=10, max_depth=35, min_samples_leaf=4, max_features=log2: 0.6593
R^2 with n_estimators=10, max_depth=40, min_samples_leaf=1, max_features=sqrt: 0.7276
R^2 with n_estimators=10, max_depth=40, min_samples_leaf=1, max_features=log2: 0.7197
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R^2 with n_estimators=10, max_depth=40, min_samples_leaf=4, max_features=sqrt: 0.6863
R^2 with n_estimators=10, max_depth=40, min_samples_leaf=4, max_features=log2: 0.6593
R^2 with n_estimators=50, max_depth=10, min_samples_leaf=1, max_features=sqrt: 0.5773
R^2 with n_estimators=50, max_depth=10, min_samples_leaf=1, max_features=log2: 0.5475
R^2 with n_estimators=50, max_depth=10, min_samples_leaf=2, max_features=sqrt: 0.5669
R^2 with n_estimators=50, max_depth=10, min_samples_leaf=2, max_features=log2: 0.5350
R^2 with n_estimators=50, max_depth=10, min_samples_leaf=4, max_features=sqrt: 0.5636

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R^2 with n_estimators=50, max_depth=15, min_samples_leaf=2, max_features=log2: 0.6899

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R^2 with n_estimators=50, max_depth=20, min_samples_leaf=1, max_features=sqrt: 0.7551

R^2 with n_estimators=50, max_depth=20, min_samples_leaf=1, max_features=log2: 0.7505

R^2 with n_estimators=50, max_depth=20, min_samples_leaf=2, max_features=sqrt: 0.7354

R^2 with n_estimators=50, max_depth=20, min_samples_leaf=2, max_features=log2: 0.7237

R^2 with n_estimators=50, max_depth=20, min_samples_leaf=4, max_features=sqrt: 0.7093

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R^2 with n_estimators=50, max_depth=25, min_samples_leaf=4, max_features=sqrt: 0.7109

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R^2 with n_estimators=50, max_depth=35, min_samples_leaf=1, max_features=log2: 0.7582

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R^2 with n_estimators=100, max_depth=25, min_samples_leaf=2, max_features=log2: 0.7372

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R^2 with n_estimators=100, max_depth=30, min_samples_leaf=4, max_features=sqrt: 0.7144

R^2 with n_estimators=100, max_depth=30, min_samples_leaf=4, max_features=log2: 0.6970

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R^2 with n_estimators=100, max_depth=35, min_samples_leaf=1, max_features=log2: 0.7635

R^2 with n_estimators=100, max_depth=35, min_samples_leaf=2, max_features=sqrt: 0.7479

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R^2 with n_estimators=100, max_depth=40, min_samples_leaf=1, max_features=log2: 0.7613

R^2 with n_estimators=100, max_depth=40, min_samples_leaf=2, max_features=sqrt: 0.7480

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R^2 with n_estimators=110, max_depth=10, min_samples_leaf=1, max_features=sqrt: 0.5799

R^2 with n_estimators=110, max_depth=10, min_samples_leaf=1, max_features=log2: 0.5480

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R^2 with n_estimators=110, max_depth=15, min_samples_leaf=2, max_features=log2: 0.6946

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R^2 with n_estimators=110, max_depth=30, min_samples_leaf=1, max_features=log2: 0.7629

R^2 with n_estimators=110, max_depth=30, min_samples_leaf=2, max_features=sqrt: 0.7465

R^2 with n_estimators=110, max_depth=30, min_samples_leaf=2, max_features=log2: 0.7410

R^2 with n_estimators=110, max_depth=30, min_samples_leaf=4, max_features=sqrt: 0.7141

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R^2 with n_estimators=150, max_depth=15, min_samples_leaf=1, max_features=sqrt: 0.7230

R^2 with n_estimators=150, max_depth=15, min_samples_leaf=1, max_features=log2: 0.7093

R^2 with n_estimators=150, max_depth=15, min_samples_leaf=2, max_features=sqrt: 0.7095

R^2 with n_estimators=150, max_depth=15, min_samples_leaf=2, max_features=log2: 0.6959

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R^2 with n_estimators=150, max_depth=20, min_samples_leaf=1, max_features=log2: 0.7543

R^2 with n_estimators=150, max_depth=20, min_samples_leaf=2, max_features=sqrt: 0.7433

R^2 with n_estimators=150, max_depth=20, min_samples_leaf=2, max_features=log2: 0.7340

R^2 with n_estimators=150, max_depth=20, min_samples_leaf=4, max_features=sqrt: 0.7128

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R^2 with n_estimators=150, max_depth=25, min_samples_leaf=2, max_features=log2: 0.7407

R^2 with n_estimators=150, max_depth=25, min_samples_leaf=4, max_features=sqrt: 0.7146

R^2 with n_estimators=150, max_depth=25, min_samples_leaf=4, max_features=log2: 0.6997

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R^2 with n_estimators=150, max_depth=30, min_samples_leaf=1, max_features=log2: 0.7652

R^2 with n_estimators=150, max_depth=30, min_samples_leaf=2, max_features=sqrt: 0.7495

R^2 with n_estimators=150, max_depth=30, min_samples_leaf=2, max_features=log2: 0.7425

R^2 with n_estimators=150, max_depth=30, min_samples_leaf=4, max_features=sqrt: 0.7161

R^2 with n_estimators=150, max_depth=30, min_samples_leaf=4, max_features=log2: 0.6999

R^2 with n_estimators=150, max_depth=35, min_samples_leaf=1, max_features=sqrt: 0.7658

R^2 with n_estimators=150, max_depth=35, min_samples_leaf=1, max_features=log2: 0.7655

R^2 with n_estimators=150, max_depth=35, min_samples_leaf=2, max_features=sqrt: 0.7504

R^2 with n_estimators=150, max_depth=35, min_samples_leaf=2, max_features=log2: 0.7417

R^2 with n_estimators=150, max_depth=35, min_samples_leaf=4, max_features=sqrt: 0.7159

R^2 with n_estimators=150, max_depth=35, min_samples_leaf=4, max_features=log2: 0.7002

R^2 with n_estimators=150, max_depth=40, min_samples_leaf=1, max_features=sqrt: 0.7658

R^2 with n_estimators=150, max_depth=40, min_samples_leaf=1, max_features=log2: 0.7636

R^2 with n_estimators=150, max_depth=40, min_samples_leaf=2, max_features=sqrt: 0.7503

R^2 with n_estimators=150, max_depth=40, min_samples_leaf=2, max_features=log2: 0.7419

R^2 with n_estimators=150, max_depth=40, min_samples_leaf=4, max_features=sqrt: 0.7159

R^2 with n_estimators=150, max_depth=40, min_samples_leaf=4, max_features=log2: 0.7004

R^2 with n_estimators=200, max_depth=10, min_samples_leaf=1, max_features=sqrt: 0.5820

R^2 with n_estimators=200, max_depth=10, min_samples_leaf=1, max_features=log2: 0.5517

R^2 with n_estimators=200, max_depth=10, min_samples_leaf=2, max_features=sqrt: 0.5757

R^2 with n_estimators=200, max_depth=10, min_samples_leaf=2, max_features=log2: 0.5429

R^2 with n_estimators=200, max_depth=10, min_samples_leaf=4, max_features=sqrt: 0.5692

R^2 with n_estimators=200, max_depth=10, min_samples_leaf=4, max_features=log2: 0.5368

R^2 with n_estimators=200, max_depth=15, min_samples_leaf=1, max_features=sqrt: 0.7238

R^2 with n_estimators=200, max_depth=15, min_samples_leaf=1, max_features=log2: 0.7092

R^2 with n_estimators=200, max_depth=15, min_samples_leaf=2, max_features=sqrt: 0.7111

R^2 with n_estimators=200, max_depth=15, min_samples_leaf=2, max_features=log2: 0.6968

R^2 with n_estimators=200, max_depth=15, min_samples_leaf=4, max_features=sqrt: 0.6859

R^2 with n_estimators=200, max_depth=15, min_samples_leaf=4, max_features=log2: 0.6614

R^2 with n_estimators=200, max_depth=20, min_samples_leaf=1, max_features=sqrt: 0.7601

R^2 with n_estimators=200, max_depth=20, min_samples_leaf=1, max_features=log2: 0.7552

R^2 with n_estimators=200, max_depth=20, min_samples_leaf=2, max_features=sqrt: 0.7444

R^2 with n_estimators=200, max_depth=20, min_samples_leaf=2, max_features=log2: 0.7341

R^2 with n_estimators=200, max_depth=20, min_samples_leaf=4, max_features=sqrt: 0.7140

R^2 with n_estimators=200, max_depth=20, min_samples_leaf=4, max_features=log2: 0.6961

R^2 with n_estimators=200, max_depth=25, min_samples_leaf=1, max_features=sqrt: 0.7653

R^2 with n_estimators=200, max_depth=25, min_samples_leaf=1, max_features=log2: 0.7630

R^2 with n_estimators=200, max_depth=25, min_samples_leaf=2, max_features=sqrt: 0.7521

R^2 with n_estimators=200, max_depth=25, min_samples_leaf=2, max_features=log2: 0.7417

R^2 with n_estimators=200, max_depth=25, min_samples_leaf=4, max_features=sqrt: 0.7160

R^2 with n_estimators=200, max_depth=25, min_samples_leaf=4, max_features=log2: 0.7001

R^2 with n_estimators=200, max_depth=30, min_samples_leaf=1, max_features=sqrt: 0.7664

R^2 with n_estimators=200, max_depth=30, min_samples_leaf=1, max_features=log2: 0.7658

R^2 with n_estimators=200, max_depth=30, min_samples_leaf=2, max_features=sqrt: 0.7493

R^2 with n_estimators=200, max_depth=30, min_samples_leaf=2, max_features=log2: 0.7438

R^2 with n_estimators=200, max_depth=30, min_samples_leaf=4, max_features=sqrt: 0.7169

R^2 with n_estimators=200, max_depth=30, min_samples_leaf=4, max_features=log2: 0.7005

R^2 with n_estimators=200, max_depth=35, min_samples_leaf=1, max_features=sqrt: 0.7661

R^2 with n_estimators=200, max_depth=35, min_samples_leaf=1, max_features=log2: 0.7657

R^2 with n_estimators=200, max_depth=35, min_samples_leaf=2, max_features=sqrt: 0.7496

R^2 with n_estimators=200, max_depth=35, min_samples_leaf=2, max_features=log2: 0.7428

R^2 with n_estimators=200, max_depth=35, min_samples_leaf=4, max_features=sqrt: 0.7168

R^2 with n_estimators=200, max_depth=35, min_samples_leaf=4, max_features=log2: 0.7006

R^2 with n_estimators=200, max_depth=40, min_samples_leaf=1, max_features=sqrt: 0.7653

R^2 with n_estimators=200, max_depth=40, min_samples_leaf=1, max_features=log2: 0.7649

R^2 with n_estimators=200, max_depth=40, min_samples_leaf=2, max_features=sqrt: 0.7496

R^2 with n_estimators=200, max_depth=40, min_samples_leaf=2, max_features=log2: 0.7427

R^2 with n_estimators=200, max_depth=40, min_samples_leaf=4, max_features=sqrt: 0.7169

R^2 with n_estimators=200, max_depth=40, min_samples_leaf=4, max_features=log2: 0.7008

R^2 with n_estimators=500, max_depth=10, min_samples_leaf=1, max_features=sqrt: 0.5836

R^2 with n_estimators=500, max_depth=10, min_samples_leaf=1, max_features=log2: 0.5521

R^2 with n_estimators=500, max_depth=10, min_samples_leaf=2, max_features=sqrt: 0.5768

R^2 with n_estimators=500, max_depth=10, min_samples_leaf=2, max_features=log2: 0.5452

R^2 with n_estimators=500, max_depth=10, min_samples_leaf=4, max_features=sqrt: 0.5691

R^2 with n_estimators=500, max_depth=10, min_samples_leaf=4, max_features=log2: 0.5346

R^2 with n_estimators=500, max_depth=15, min_samples_leaf=1, max_features=sqrt: 0.7244

R^2 with n_estimators=500, max_depth=15, min_samples_leaf=1, max_features=log2: 0.7109

R^2 with n_estimators=500, max_depth=15, min_samples_leaf=2, max_features=sqrt: 0.7131

R^2 with n_estimators=500, max_depth=15, min_samples_leaf=2, max_features=log2: 0.6977

R^2 with n_estimators=500, max_depth=15, min_samples_leaf=4, max_features=sqrt: 0.6872

R^2 with n_estimators=500, max_depth=15, min_samples_leaf=4, max_features=log2: 0.6638

R^2 with n_estimators=500, max_depth=20, min_samples_leaf=1, max_features=sqrt: 0.7612

R^2 with n_estimators=500, max_depth=20, min_samples_leaf=1, max_features=log2: 0.7557

R^2 with n_estimators=500, max_depth=20, min_samples_leaf=2, max_features=sqrt: 0.7463

R^2 with n_estimators=500, max_depth=20, min_samples_leaf=2, max_features=log2: 0.7349

R^2 with n_estimators=500, max_depth=20, min_samples_leaf=4, max_features=sqrt: 0.7142

R^2 with n_estimators=500, max_depth=20, min_samples_leaf=4, max_features=log2: 0.6954

R^2 with n_estimators=500, max_depth=25, min_samples_leaf=1, max_features=sqrt: 0.7668

R^2 with n_estimators=500, max_depth=25, min_samples_leaf=1, max_features=log2: 0.7639

R^2 with n_estimators=500, max_depth=25, min_samples_leaf=2, max_features=sqrt: 0.7524

R^2 with n_estimators=500, max_depth=25, min_samples_leaf=2, max_features=log2: 0.7428

R^2 with n_estimators=500, max_depth=25, min_samples_leaf=4, max_features=sqrt: 0.7181

R^2 with n_estimators=500, max_depth=25, min_samples_leaf=4, max_features=log2: 0.7004

R^2 with n_estimators=500, max_depth=30, min_samples_leaf=1, max_features=sqrt: 0.7680

R^2 with n_estimators=500, max_depth=30, min_samples_leaf=1, max_features=log2: 0.7662

R^2 with n_estimators=500, max_depth=30, min_samples_leaf=2, max_features=sqrt: 0.7511

R^2 with n_estimators=500, max_depth=30, min_samples_leaf=2, max_features=log2: 0.7437

R^2 with n_estimators=500, max_depth=30, min_samples_leaf=4, max_features=sqrt: 0.7181

R^2 with n_estimators=500, max_depth=30, min_samples_leaf=4, max_features=log2: 0.7001

R^2 with n_estimators=500, max_depth=35, min_samples_leaf=1, max_features=sqrt: 0.7672

R^2 with n_estimators=500, max_depth=35, min_samples_leaf=1, max_features=log2: 0.7656

R^2 with n_estimators=500, max_depth=35, min_samples_leaf=2, max_features=sqrt: 0.7516

R^2 with n_estimators=500, max_depth=35, min_samples_leaf=2, max_features=log2: 0.7425

R^2 with n_estimators=500, max_depth=35, min_samples_leaf=4, max_features=sqrt: 0.7181

R^2 with n_estimators=500, max_depth=35, min_samples_leaf=4, max_features=log2: 0.7000

R^2 with n_estimators=500, max_depth=40, min_samples_leaf=1, max_features=sqrt: 0.7677

R^2 with n_estimators=500, max_depth=40, min_samples_leaf=1, max_features=log2: 0.7651

R^2 with n_estimators=500, max_depth=40, min_samples_leaf=2, max_features=sqrt: 0.7513

R^2 with n_estimators=500, max_depth=40, min_samples_leaf=2, max_features=log2: 0.7428

R^2 with n_estimators=500, max_depth=40, min_samples_leaf=4, max_features=sqrt: 0.7182

R^2 with n_estimators=500, max_depth=40, min_samples_leaf=4, max_features=log2: 0.7001

R^2 with n_estimators=1000, max_depth=10, min_samples_leaf=1, max_features=sqrt: 0.5817

R^2 with n_estimators=1000, max_depth=10, min_samples_leaf=1, max_features=log2: 0.5527

R^2 with n_estimators=1000, max_depth=10, min_samples_leaf=2, max_features=sqrt: 0.5772

R^2 with n_estimators=1000, max_depth=10, min_samples_leaf=2, max_features=log2: 0.5449

R^2 with n_estimators=1000, max_depth=10, min_samples_leaf=4, max_features=sqrt: 0.5679

R^2 with n_estimators=1000, max_depth=10, min_samples_leaf=4, max_features=log2: 0.5359

R^2 with n_estimators=1000, max_depth=15, min_samples_leaf=1, max_features=sqrt: 0.7246

R^2 with n_estimators=1000, max_depth=15, min_samples_leaf=1, max_features=log2: 0.7123

R^2 with n_estimators=1000, max_depth=15, min_samples_leaf=2, max_features=sqrt: 0.7129

R^2 with n_estimators=1000, max_depth=15, min_samples_leaf=2, max_features=log2: 0.6967

R^2 with n_estimators=1000, max_depth=15, min_samples_leaf=4, max_features=sqrt: 0.6874

R^2 with n_estimators=1000, max_depth=15, min_samples_leaf=4, max_features=log2: 0.6651

R^2 with n_estimators=1000, max_depth=20, min_samples_leaf=1, max_features=sqrt: 0.7611

R^2 with n_estimators=1000, max_depth=20, min_samples_leaf=1, max_features=log2: 0.7559

R^2 with n_estimators=1000, max_depth=20, min_samples_leaf=2, max_features=sqrt: 0.7461

R^2 with n_estimators=1000, max_depth=20, min_samples_leaf=2, max_features=log2: 0.7350

R^2 with n_estimators=1000, max_depth=20, min_samples_leaf=4, max_features=sqrt: 0.7141

R^2 with n_estimators=1000, max_depth=20, min_samples_leaf=4, max_features=log2: 0.6962

R^2 with n_estimators=1000, max_depth=25, min_samples_leaf=1, max_features=sqrt: 0.7669

R^2 with n_estimators=1000, max_depth=25, min_samples_leaf=1, max_features=log2: 0.7641

R^2 with n_estimators=1000, max_depth=25, min_samples_leaf=2, max_features=sqrt: 0.7527

R^2 with n_estimators=1000, max_depth=25, min_samples_leaf=2, max_features=log2: 0.7429

R^2 with n_estimators=1000, max_depth=25, min_samples_leaf=4, max_features=sqrt: 0.7180

R^2 with n_estimators=1000, max_depth=25, min_samples_leaf=4, max_features=log2: 0.7007

R^2 with n_estimators=1000, max_depth=30, min_samples_leaf=1, max_features=sqrt: 0.7677

R^2 with n_estimators=1000, max_depth=30, min_samples_leaf=1, max_features=log2: 0.7653

R^2 with n_estimators=1000, max_depth=30, min_samples_leaf=2, max_features=sqrt: 0.7513

R^2 with n_estimators=1000, max_depth=30, min_samples_leaf=2, max_features=log2: 0.7433

R^2 with n_estimators=1000, max_depth=30, min_samples_leaf=4, max_features=sqrt: 0.7176

R^2 with n_estimators=1000, max_depth=30, min_samples_leaf=4, max_features=log2: 0.7006

R^2 with n_estimators=1000, max_depth=35, min_samples_leaf=1, max_features=sqrt: 0.7674

R^2 with n_estimators=1000, max_depth=35, min_samples_leaf=1, max_features=log2: 0.7658

R^2 with n_estimators=1000, max_depth=35, min_samples_leaf=2, max_features=sqrt: 0.7517

R^2 with n_estimators=1000, max_depth=35, min_samples_leaf=2, max_features=log2: 0.7428

R^2 with n_estimators=1000, max_depth=35, min_samples_leaf=4, max_features=sqrt: 0.7176

R^2 with n_estimators=1000, max_depth=35, min_samples_leaf=4, max_features=log2: 0.7002

R^2 with n_estimators=1000, max_depth=40, min_samples_leaf=1, max_features=sqrt: 0.7682

R^2 with n_estimators=1000, max_depth=40, min_samples_leaf=1, max_features=log2: 0.7651

R^2 with n_estimators=1000, max_depth=40, min_samples_leaf=2, max_features=sqrt: 0.7516

R^2 with n_estimators=1000, max_depth=40, min_samples_leaf=2, max_features=log2: 0.7430

R^2 with n_estimators=1000, max_depth=40, min_samples_leaf=4, max_features=sqrt: 0.7177

R^2 with n_estimators=1000, max_depth=40, min_samples_leaf=4, max_features=log2: 0.7003

R^2 with n_estimators=2000, max_depth=10, min_samples_leaf=1, max_features=sqrt: 0.5819

R^2 with n_estimators=2000, max_depth=10, min_samples_leaf=1, max_features=log2: 0.5534

R^2 with n_estimators=2000, max_depth=10, min_samples_leaf=2, max_features=sqrt: 0.5776

R^2 with n_estimators=2000, max_depth=10, min_samples_leaf=2, max_features=log2: 0.5472

R^2 with n_estimators=2000, max_depth=10, min_samples_leaf=4, max_features=sqrt: 0.5684

R^2 with n_estimators=2000, max_depth=10, min_samples_leaf=4, max_features=log2: 0.5367

R^2 with n_estimators=2000, max_depth=15, min_samples_leaf=1, max_features=sqrt: 0.7256

R^2 with n_estimators=2000, max_depth=15, min_samples_leaf=1, max_features=log2: 0.7125

R^2 with n_estimators=2000, max_depth=15, min_samples_leaf=2, max_features=sqrt: 0.7137

R^2 with n_estimators=2000, max_depth=15, min_samples_leaf=2, max_features=log2: 0.6957

R^2 with n_estimators=2000, max_depth=15, min_samples_leaf=4, max_features=sqrt: 0.6881

R^2 with n_estimators=2000, max_depth=15, min_samples_leaf=4, max_features=log2: 0.6653

R^2 with n_estimators=2000, max_depth=20, min_samples_leaf=1, max_features=sqrt: 0.7615

R^2 with n_estimators=2000, max_depth=20, min_samples_leaf=1, max_features=log2: 0.7564

R^2 with n_estimators=2000, max_depth=20, min_samples_leaf=2, max_features=sqrt: 0.7466

R^2 with n_estimators=2000, max_depth=20, min_samples_leaf=2, max_features=log2: 0.7352

R^2 with n_estimators=2000, max_depth=20, min_samples_leaf=4, max_features=sqrt: 0.7142

R^2 with n_estimators=2000, max_depth=20, min_samples_leaf=4, max_features=log2: 0.6968

R^2 with n_estimators=2000, max_depth=25, min_samples_leaf=1, max_features=sqrt: 0.7676

R^2 with n_estimators=2000, max_depth=25, min_samples_leaf=1, max_features=log2: 0.7643

R^2 with n_estimators=2000, max_depth=25, min_samples_leaf=2, max_features=sqrt: 0.7523

R^2 with n_estimators=2000, max_depth=25, min_samples_leaf=2, max_features=log2: 0.7430

R^2 with n_estimators=2000, max_depth=25, min_samples_leaf=4, max_features=sqrt: 0.7179

R^2 with n_estimators=2000, max_depth=25, min_samples_leaf=4, max_features=log2: 0.7009

R^2 with n_estimators=2000, max_depth=30, min_samples_leaf=1, max_features=sqrt: 0.7679

R^2 with n_estimators=2000, max_depth=30, min_samples_leaf=1, max_features=log2: 0.7651

R^2 with n_estimators=2000, max_depth=30, min_samples_leaf=2, max_features=sqrt: 0.7515

R^2 with n_estimators=2000, max_depth=30, min_samples_leaf=2, max_features=log2: 0.7436

R^2 with n_estimators=2000, max_depth=30, min_samples_leaf=4, max_features=sqrt: 0.7183

R^2 with n_estimators=2000, max_depth=30, min_samples_leaf=4, max_features=log2: 0.7011

R^2 with n_estimators=2000, max_depth=35, min_samples_leaf=1, max_features=sqrt: 0.7679

R² with n_estimators=2000, max_depth=35, min_samples_leaf=1, max_features=log2: 0.7654

R² with n_estimators=2000, max_depth=35, min_samples_leaf=2, max_features=sqrt: 0.7519

R² with n_estimators=2000, max_depth=35, min_samples_leaf=2, max_features=log2: 0.7431

R² with n_estimators=2000, max_depth=35, min_samples_leaf=4, max_features=sqrt: 0.7182

R² with n_estimators=2000, max_depth=35, min_samples_leaf=4, max_features=log2: 0.7010

R² with n_estimators=2000, max_depth=40, min_samples_leaf=1, max_features=sqrt: 0.7683

R² with n_estimators=2000, max_depth=40, min_samples_leaf=1, max_features=log2: 0.7652

R² with n_estimators=2000, max_depth=40, min_samples_leaf=2, max_features=sqrt: 0.7520

R² with n_estimators=2000, max_depth=40, min_samples_leaf=2, max_features=log2: 0.7431

R² with n_estimators=2000, max_depth=40, min_samples_leaf=4, max_features=sqrt: 0.7182

R² with n_estimators=2000, max_depth=40, min_samples_leaf=4, max_features=log2: 0.7010

Best parameters found on the normalized dataset:

{'n_estimators': 2000, 'max_depth': 40, 'min_samples_leaf': 1, 'max_features': 'sqrt'} 0.7683

Testing different parameter combinations for Random Forest with PCA (test set 15%)

```
param_grid_normalized = {
    'n_estimators': [10, 50, 100, 110, 150, 200, 500, 1000],
    'max_depth': [10, 15, 20, 25, 30, 35, 40],
    'min_samples_leaf': [1, 2, 4],
    'max_features': ['sqrt', 'log2']
}
```

Testing different parameter combinations with PCA:

R^2

R^2 with n_estimators=10, max_depth=10, min_samples_leaf=1, max_features=sqrt: 0.4346
R^2 with n_estimators=10, max_depth=10, min_samples_leaf=1, max_features=log2: 0.3907
R^2 with n_estimators=10, max_depth=10, min_samples_leaf=2, max_features=sqrt: 0.4227
R^2 with n_estimators=10, max_depth=10, min_samples_leaf=2, max_features=log2: 0.4089
R^2 with n_estimators=10, max_depth=10, min_samples_leaf=4, max_features=sqrt: 0.4288
R^2 with n_estimators=10, max_depth=10, min_samples_leaf=4, max_features=log2: 0.3823
R^2 with n_estimators=10, max_depth=15, min_samples_leaf=1, max_features=sqrt: 0.5787
R^2 with n_estimators=10, max_depth=15, min_samples_leaf=1, max_features=log2: 0.5759
R^2 with n_estimators=10, max_depth=15, min_samples_leaf=2, max_features=sqrt: 0.5690
R^2 with n_estimators=10, max_depth=15, min_samples_leaf=2, max_features=log2: 0.5606
R^2 with n_estimators=10, max_depth=15, min_samples_leaf=4, max_features=sqrt: 0.5751
R^2 with n_estimators=10, max_depth=15, min_samples_leaf=4, max_features=log2: 0.5424
R^2 with n_estimators=10, max_depth=20, min_samples_leaf=1, max_features=sqrt: 0.6397
R^2 with n_estimators=10, max_depth=20, min_samples_leaf=1, max_features=log2: 0.6231
R^2 with n_estimators=10, max_depth=20, min_samples_leaf=2, max_features=sqrt: 0.6426
R^2 with n_estimators=10, max_depth=20, min_samples_leaf=2, max_features=log2: 0.6200
R^2 with n_estimators=10, max_depth=20, min_samples_leaf=4, max_features=sqrt: 0.6095
R^2 with n_estimators=10, max_depth=20, min_samples_leaf=4, max_features=log2: 0.5972
R^2 with n_estimators=10, max_depth=25, min_samples_leaf=1, max_features=sqrt: 0.6463
R^2 with n_estimators=10, max_depth=25, min_samples_leaf=1, max_features=log2: 0.6423
R^2 with n_estimators=10, max_depth=25, min_samples_leaf=2, max_features=sqrt: 0.6376

R^2 with n_estimators=10, max_depth=25, min_samples_leaf=2, max_features=log2: 0.6345

R^2 with n_estimators=10, max_depth=25, min_samples_leaf=4, max_features=sqrt: 0.6105

R^2 with n_estimators=10, max_depth=25, min_samples_leaf=4, max_features=log2: 0.6016

R^2 with n_estimators=10, max_depth=30, min_samples_leaf=1, max_features=sqrt: 0.6446

R^2 with n_estimators=10, max_depth=30, min_samples_leaf=1, max_features=log2: 0.6367

R^2 with n_estimators=10, max_depth=30, min_samples_leaf=2, max_features=sqrt: 0.6366

R^2 with n_estimators=10, max_depth=30, min_samples_leaf=2, max_features=log2: 0.6469

R^2 with n_estimators=10, max_depth=30, min_samples_leaf=4, max_features=sqrt: 0.6086

R^2 with n_estimators=10, max_depth=30, min_samples_leaf=4, max_features=log2: 0.6042

R^2 with n_estimators=10, max_depth=35, min_samples_leaf=1, max_features=sqrt: 0.6477

R^2 with n_estimators=10, max_depth=35, min_samples_leaf=1, max_features=log2: 0.6257

R^2 with n_estimators=10, max_depth=35, min_samples_leaf=2, max_features=sqrt: 0.6488

R^2 with n_estimators=10, max_depth=35, min_samples_leaf=2, max_features=log2: 0.6458

R^2 with n_estimators=10, max_depth=35, min_samples_leaf=4, max_features=sqrt: 0.6125

R^2 with n_estimators=10, max_depth=35, min_samples_leaf=4, max_features=log2: 0.6034

R^2 with n_estimators=10, max_depth=40, min_samples_leaf=1, max_features=sqrt: 0.6485

R^2 with n_estimators=10, max_depth=40, min_samples_leaf=1, max_features=log2: 0.6225

R^2 with n_estimators=10, max_depth=40, min_samples_leaf=2, max_features=sqrt: 0.6492

R^2 with n_estimators=10, max_depth=40, min_samples_leaf=2, max_features=log2: 0.6442

R^2 with n_estimators=10, max_depth=40, min_samples_leaf=4, max_features=sqrt: 0.6145

R^2 with n_estimators=10, max_depth=40, min_samples_leaf=4, max_features=log2: 0.6034

R^2 with n_estimators=50, max_depth=10, min_samples_leaf=1, max_features=sqrt: 0.4470

R^2 with n_estimators=50, max_depth=10, min_samples_leaf=1, max_features=log2: 0.4334

R^2 with n_estimators=50, max_depth=10, min_samples_leaf=2, max_features=sqrt: 0.4395

R^2 with n_estimators=50, max_depth=10, min_samples_leaf=2, max_features=log2: 0.4354

R^2 with n_estimators=50, max_depth=10, min_samples_leaf=4, max_features=sqrt: 0.4356

R^2 with n_estimators=50, max_depth=10, min_samples_leaf=4, max_features=log2: 0.4158

R^2 with n_estimators=50, max_depth=15, min_samples_leaf=1, max_features=sqrt: 0.6164

R^2 with n_estimators=50, max_depth=15, min_samples_leaf=1, max_features=log2: 0.6074

R^2 with n_estimators=50, max_depth=15, min_samples_leaf=2, max_features=sqrt: 0.6120

R^2 with n_estimators=50, max_depth=15, min_samples_leaf=2, max_features=log2: 0.5935

R^2 with n_estimators=50, max_depth=15, min_samples_leaf=4, max_features=sqrt: 0.5984

R^2 with n_estimators=50, max_depth=15, min_samples_leaf=4, max_features=log2: 0.5720

R^2 with n_estimators=50, max_depth=20, min_samples_leaf=1, max_features=sqrt: 0.6789

R^2 with n_estimators=50, max_depth=20, min_samples_leaf=1, max_features=log2: 0.6663

R^2 with n_estimators=50, max_depth=20, min_samples_leaf=2, max_features=sqrt: 0.6671

R^2 with n_estimators=50, max_depth=20, min_samples_leaf=2, max_features=log2: 0.6617

R^2 with n_estimators=50, max_depth=20, min_samples_leaf=4, max_features=sqrt: 0.6422

R^2 with n_estimators=50, max_depth=20, min_samples_leaf=4, max_features=log2: 0.6356

R^2 with n_estimators=50, max_depth=25, min_samples_leaf=1, max_features=sqrt: 0.6878

R^2 with n_estimators=50, max_depth=25, min_samples_leaf=1, max_features=log2: 0.6824

R^2 with n_estimators=50, max_depth=25, min_samples_leaf=2, max_features=sqrt: 0.6802

R^2 with n_estimators=50, max_depth=25, min_samples_leaf=2, max_features=log2: 0.6739

R^2 with n_estimators=50, max_depth=25, min_samples_leaf=4, max_features=sqrt: 0.6444

R^2 with n_estimators=50, max_depth=25, min_samples_leaf=4, max_features=log2: 0.6414

R^2 with n_estimators=50, max_depth=30, min_samples_leaf=1, max_features=sqrt: 0.6863

R^2 with n_estimators=50, max_depth=30, min_samples_leaf=1, max_features=log2: 0.6851

R^2 with n_estimators=50, max_depth=30, min_samples_leaf=2, max_features=sqrt: 0.6756

R^2 with n_estimators=50, max_depth=30, min_samples_leaf=2, max_features=log2: 0.6748

R^2 with n_estimators=50, max_depth=30, min_samples_leaf=4, max_features=sqrt: 0.6489

R^2 with n_estimators=50, max_depth=30, min_samples_leaf=4, max_features=log2: 0.6426

R^2 with n_estimators=50, max_depth=35, min_samples_leaf=1, max_features=sqrt: 0.6853

R^2 with n_estimators=50, max_depth=35, min_samples_leaf=1, max_features=log2: 0.6813

R^2 with n_estimators=50, max_depth=35, min_samples_leaf=2, max_features=sqrt: 0.6784

R^2 with n_estimators=50, max_depth=35, min_samples_leaf=2, max_features=log2: 0.6718

R^2 with n_estimators=50, max_depth=35, min_samples_leaf=4, max_features=sqrt: 0.6510

R^2 with n_estimators=50, max_depth=35, min_samples_leaf=4, max_features=log2: 0.6411

R^2 with n_estimators=50, max_depth=40, min_samples_leaf=1, max_features=sqrt: 0.6863

R^2 with n_estimators=50, max_depth=40, min_samples_leaf=1, max_features=log2: 0.6806

R^2 with n_estimators=50, max_depth=40, min_samples_leaf=2, max_features=sqrt: 0.6790

R^2 with n_estimators=50, max_depth=40, min_samples_leaf=2, max_features=log2: 0.6714

R^2 with n_estimators=50, max_depth=40, min_samples_leaf=4, max_features=sqrt: 0.6513

R^2 with n_estimators=50, max_depth=40, min_samples_leaf=4, max_features=log2: 0.6421

R^2 with n_estimators=100, max_depth=10, min_samples_leaf=1, max_features=sqrt: 0.4527

R^2 with n_estimators=100, max_depth=10, min_samples_leaf=1, max_features=log2: 0.4312

R^2 with n_estimators=100, max_depth=10, min_samples_leaf=2, max_features=sqrt: 0.4489

R^2 with n_estimators=100, max_depth=10, min_samples_leaf=2, max_features=log2: 0.4353

R^2 with n_estimators=100, max_depth=10, min_samples_leaf=4, max_features=sqrt: 0.4411

R^2 with n_estimators=100, max_depth=10, min_samples_leaf=4, max_features=log2: 0.4191

R^2 with n_estimators=100, max_depth=15, min_samples_leaf=1, max_features=sqrt: 0.6222

R^2 with n_estimators=100, max_depth=15, min_samples_leaf=1, max_features=log2: 0.6081

R^2 with n_estimators=100, max_depth=15, min_samples_leaf=2, max_features=sqrt: 0.6193

R^2 with n_estimators=100, max_depth=15, min_samples_leaf=2, max_features=log2: 0.6010

R^2 with n_estimators=100, max_depth=15, min_samples_leaf=4, max_features=sqrt: 0.6008

R^2 with n_estimators=100, max_depth=15, min_samples_leaf=4, max_features=log2: 0.5767

R^2 with n_estimators=100, max_depth=20, min_samples_leaf=1, max_features=sqrt: 0.6829

R^2 with n_estimators=100, max_depth=20, min_samples_leaf=1, max_features=log2: 0.6714

R^2 with n_estimators=100, max_depth=20, min_samples_leaf=2, max_features=sqrt: 0.6716

R^2 with n_estimators=100, max_depth=20, min_samples_leaf=2, max_features=log2: 0.6653

R^2 with n_estimators=100, max_depth=20, min_samples_leaf=4, max_features=sqrt: 0.6458

R^2 with n_estimators=100, max_depth=20, min_samples_leaf=4, max_features=log2: 0.6395

R^2 with n_estimators=100, max_depth=25, min_samples_leaf=1, max_features=sqrt: 0.6928

R^2 with n_estimators=100, max_depth=25, min_samples_leaf=1, max_features=log2: 0.6869

R^2 with n_estimators=100, max_depth=25, min_samples_leaf=2, max_features=sqrt: 0.6830

R^2 with n_estimators=100, max_depth=25, min_samples_leaf=2, max_features=log2: 0.6779

R^2 with n_estimators=100, max_depth=25, min_samples_leaf=4, max_features=sqrt: 0.6504

R^2 with n_estimators=100, max_depth=25, min_samples_leaf=4, max_features=log2: 0.6450

R^2 with n_estimators=100, max_depth=30, min_samples_leaf=1, max_features=sqrt: 0.6946

R^2 with n_estimators=100, max_depth=30, min_samples_leaf=1, max_features=log2: 0.6899

R^2 with n_estimators=100, max_depth=30, min_samples_leaf=2, max_features=sqrt: 0.6813

R^2 with n_estimators=100, max_depth=30, min_samples_leaf=2, max_features=log2: 0.6808

R^2 with n_estimators=100, max_depth=30, min_samples_leaf=4, max_features=sqrt: 0.6544

R^2 with n_estimators=100, max_depth=30, min_samples_leaf=4, max_features=log2: 0.6462

R^2 with n_estimators=100, max_depth=35, min_samples_leaf=1, max_features=sqrt: 0.6928

R^2 with n_estimators=100, max_depth=35, min_samples_leaf=1, max_features=log2: 0.6897

R^2 with n_estimators=100, max_depth=35, min_samples_leaf=2, max_features=sqrt: 0.6833

R^2 with n_estimators=100, max_depth=35, min_samples_leaf=2, max_features=log2: 0.6790

R^2 with n_estimators=100, max_depth=35, min_samples_leaf=4, max_features=sqrt: 0.6544

R^2 with n_estimators=100, max_depth=35, min_samples_leaf=4, max_features=log2: 0.6450

R^2 with n_estimators=100, max_depth=40, min_samples_leaf=1, max_features=sqrt: 0.6930

R^2 with n_estimators=100, max_depth=40, min_samples_leaf=1, max_features=log2: 0.6902

R^2 with n_estimators=100, max_depth=40, min_samples_leaf=2, max_features=sqrt: 0.6839

R^2 with n_estimators=100, max_depth=40, min_samples_leaf=2, max_features=log2: 0.6789

R^2 with n_estimators=100, max_depth=40, min_samples_leaf=4, max_features=sqrt: 0.6546

R^2 with n_estimators=100, max_depth=40, min_samples_leaf=4, max_features=log2: 0.6454

R^2 with n_estimators=110, max_depth=10, min_samples_leaf=1, max_features=sqrt: 0.4547

R^2 with n_estimators=110, max_depth=10, min_samples_leaf=1, max_features=log2: 0.4332

R^2 with n_estimators=110, max_depth=10, min_samples_leaf=2, max_features=sqrt: 0.4512

R^2 with n_estimators=110, max_depth=10, min_samples_leaf=2, max_features=log2: 0.4359

R^2 with n_estimators=110, max_depth=10, min_samples_leaf=4, max_features=sqrt: 0.4439

R^2 with n_estimators=110, max_depth=10, min_samples_leaf=4, max_features=log2: 0.4180

R^2 with n_estimators=110, max_depth=15, min_samples_leaf=1, max_features=sqrt: 0.6236

R^2 with n_estimators=110, max_depth=15, min_samples_leaf=1, max_features=log2: 0.6084

R^2 with n_estimators=110, max_depth=15, min_samples_leaf=2, max_features=sqrt: 0.6207

R^2 with n_estimators=110, max_depth=15, min_samples_leaf=2, max_features=log2: 0.6008

R^2 with n_estimators=110, max_depth=15, min_samples_leaf=4, max_features=sqrt: 0.6008

R^2 with n_estimators=110, max_depth=15, min_samples_leaf=4, max_features=log2: 0.5775

R^2 with n_estimators=110, max_depth=20, min_samples_leaf=1, max_features=sqrt: 0.6840

R^2 with n_estimators=110, max_depth=20, min_samples_leaf=1, max_features=log2: 0.6716

R^2 with n_estimators=110, max_depth=20, min_samples_leaf=2, max_features=sqrt: 0.6728

R^2 with n_estimators=110, max_depth=20, min_samples_leaf=2, max_features=log2: 0.6655

R^2 with n_estimators=110, max_depth=20, min_samples_leaf=4, max_features=sqrt: 0.6457

R^2 with n_estimators=110, max_depth=20, min_samples_leaf=4, max_features=log2: 0.6391

R^2 with n_estimators=110, max_depth=25, min_samples_leaf=1, max_features=sqrt: 0.6929

R^2 with n_estimators=110, max_depth=25, min_samples_leaf=1, max_features=log2: 0.6866

R^2 with n_estimators=110, max_depth=25, min_samples_leaf=2, max_features=sqrt: 0.6835

R^2 with n_estimators=110, max_depth=25, min_samples_leaf=2, max_features=log2: 0.6782

R^2 with n_estimators=110, max_depth=25, min_samples_leaf=4, max_features=sqrt: 0.6508

R^2 with n_estimators=110, max_depth=25, min_samples_leaf=4, max_features=log2: 0.6450

R^2 with n_estimators=110, max_depth=30, min_samples_leaf=1, max_features=sqrt: 0.6945

R^2 with n_estimators=110, max_depth=30, min_samples_leaf=1, max_features=log2: 0.6901

R^2 with n_estimators=110, max_depth=30, min_samples_leaf=2, max_features=sqrt: 0.6817

R^2 with n_estimators=110, max_depth=30, min_samples_leaf=2, max_features=log2: 0.6799

R^2 with n_estimators=110, max_depth=30, min_samples_leaf=4, max_features=sqrt: 0.6534

R^2 with n_estimators=110, max_depth=30, min_samples_leaf=4, max_features=log2: 0.6463

R^2 with n_estimators=110, max_depth=35, min_samples_leaf=1, max_features=sqrt: 0.6931

R^2 with n_estimators=110, max_depth=35, min_samples_leaf=1, max_features=log2: 0.6896

R^2 with n_estimators=110, max_depth=35, min_samples_leaf=2, max_features=sqrt: 0.6837

R^2 with n_estimators=110, max_depth=35, min_samples_leaf=2, max_features=log2: 0.6779

R^2 with n_estimators=110, max_depth=35, min_samples_leaf=4, max_features=sqrt: 0.6535

R^2 with n_estimators=110, max_depth=35, min_samples_leaf=4, max_features=log2: 0.6451

R^2 with n_estimators=110, max_depth=40, min_samples_leaf=1, max_features=sqrt: 0.6935

R^2 with n_estimators=110, max_depth=40, min_samples_leaf=1, max_features=log2: 0.6905

R^2 with n_estimators=110, max_depth=40, min_samples_leaf=2, max_features=sqrt: 0.6841

R^2 with n_estimators=110, max_depth=40, min_samples_leaf=2, max_features=log2: 0.6780

R^2 with n_estimators=110, max_depth=40, min_samples_leaf=4, max_features=sqrt: 0.6536

R^2 with n_estimators=110, max_depth=40, min_samples_leaf=4, max_features=log2: 0.6455

R^2 with n_estimators=150, max_depth=10, min_samples_leaf=1, max_features=sqrt: 0.4561

R^2 with n_estimators=150, max_depth=10, min_samples_leaf=1, max_features=log2: 0.4327

R^2 with n_estimators=150, max_depth=10, min_samples_leaf=2, max_features=sqrt: 0.4537

R^2 with n_estimators=150, max_depth=10, min_samples_leaf=2, max_features=log2: 0.4373

R^2 with n_estimators=150, max_depth=10, min_samples_leaf=4, max_features=sqrt: 0.4472

R^2 with n_estimators=150, max_depth=10, min_samples_leaf=4, max_features=log2: 0.4213

R^2 with n_estimators=150, max_depth=15, min_samples_leaf=1, max_features=sqrt: 0.6250

R^2 with n_estimators=150, max_depth=15, min_samples_leaf=1, max_features=log2: 0.6114

R^2 with n_estimators=150, max_depth=15, min_samples_leaf=2, max_features=sqrt: 0.6228

R^2 with n_estimators=150, max_depth=15, min_samples_leaf=2, max_features=log2: 0.6022

R^2 with n_estimators=150, max_depth=15, min_samples_leaf=4, max_features=sqrt: 0.6018

R^2 with n_estimators=150, max_depth=15, min_samples_leaf=4, max_features=log2: 0.5820

R^2 with n_estimators=150, max_depth=20, min_samples_leaf=1, max_features=sqrt: 0.6850

R^2 with n_estimators=150, max_depth=20, min_samples_leaf=1, max_features=log2: 0.6748

R^2 with n_estimators=150, max_depth=20, min_samples_leaf=2, max_features=sqrt: 0.6742

R^2 with n_estimators=150, max_depth=20, min_samples_leaf=2, max_features=log2: 0.6672

R^2 with n_estimators=150, max_depth=20, min_samples_leaf=4, max_features=sqrt: 0.6466

R^2 with n_estimators=150, max_depth=20, min_samples_leaf=4, max_features=log2: 0.6412

R^2 with n_estimators=150, max_depth=25, min_samples_leaf=1, max_features=sqrt: 0.6952

R^2 with n_estimators=150, max_depth=25, min_samples_leaf=1, max_features=log2: 0.6871

R^2 with n_estimators=150, max_depth=25, min_samples_leaf=2, max_features=sqrt: 0.6851

R^2 with n_estimators=150, max_depth=25, min_samples_leaf=2, max_features=log2: 0.6794

R^2 with n_estimators=150, max_depth=25, min_samples_leaf=4, max_features=sqrt: 0.6528

R^2 with n_estimators=150, max_depth=25, min_samples_leaf=4, max_features=log2: 0.6460

R^2 with n_estimators=150, max_depth=30, min_samples_leaf=1, max_features=sqrt: 0.6954

R^2 with n_estimators=150, max_depth=30, min_samples_leaf=1, max_features=log2: 0.6910

R^2 with n_estimators=150, max_depth=30, min_samples_leaf=2, max_features=sqrt: 0.6835

R^2 with n_estimators=150, max_depth=30, min_samples_leaf=2, max_features=log2: 0.6805

R^2 with n_estimators=150, max_depth=30, min_samples_leaf=4, max_features=sqrt: 0.6550

R^2 with n_estimators=150, max_depth=30, min_samples_leaf=4, max_features=log2: 0.6466

R^2 with n_estimators=150, max_depth=35, min_samples_leaf=1, max_features=sqrt: 0.6953

R^2 with n_estimators=150, max_depth=35, min_samples_leaf=1, max_features=log2: 0.6902

R^2 with n_estimators=150, max_depth=35, min_samples_leaf=2, max_features=sqrt: 0.6857

R^2 with n_estimators=150, max_depth=35, min_samples_leaf=2, max_features=log2: 0.6784

R^2 with n_estimators=150, max_depth=35, min_samples_leaf=4, max_features=sqrt: 0.6550

R^2 with n_estimators=150, max_depth=35, min_samples_leaf=4, max_features=log2: 0.6452

R^2 with n_estimators=150, max_depth=40, min_samples_leaf=1, max_features=sqrt: 0.6958

R^2 with n_estimators=150, max_depth=40, min_samples_leaf=1, max_features=log2: 0.6918

R^2 with n_estimators=150, max_depth=40, min_samples_leaf=2, max_features=sqrt: 0.6858

R^2 with n_estimators=150, max_depth=40, min_samples_leaf=2, max_features=log2: 0.6787

R^2 with n_estimators=150, max_depth=40, min_samples_leaf=4, max_features=sqrt: 0.6551

R^2 with n_estimators=150, max_depth=40, min_samples_leaf=4, max_features=log2: 0.6455

R^2 with n_estimators=200, max_depth=10, min_samples_leaf=1, max_features=sqrt: 0.4543

R^2 with n_estimators=200, max_depth=10, min_samples_leaf=1, max_features=log2: 0.4341

R^2 with n_estimators=200, max_depth=10, min_samples_leaf=2, max_features=sqrt: 0.4523

R^2 with n_estimators=200, max_depth=10, min_samples_leaf=2, max_features=log2: 0.4374

R^2 with n_estimators=200, max_depth=10, min_samples_leaf=4, max_features=sqrt: 0.4453

R^2 with n_estimators=200, max_depth=10, min_samples_leaf=4, max_features=log2: 0.4264

R^2 with n_estimators=200, max_depth=15, min_samples_leaf=1, max_features=sqrt: 0.6259

R^2 with n_estimators=200, max_depth=15, min_samples_leaf=1, max_features=log2: 0.6137

R^2 with n_estimators=200, max_depth=15, min_samples_leaf=2, max_features=sqrt: 0.6220

R^2 with n_estimators=200, max_depth=15, min_samples_leaf=2, max_features=log2: 0.6036

R^2 with n_estimators=200, max_depth=15, min_samples_leaf=4, max_features=sqrt: 0.6022

R^2 with n_estimators=200, max_depth=15, min_samples_leaf=4, max_features=log2: 0.5844

R^2 with n_estimators=200, max_depth=20, min_samples_leaf=1, max_features=sqrt: 0.6860

R^2 with n_estimators=200, max_depth=20, min_samples_leaf=1, max_features=log2: 0.6765

R^2 with n_estimators=200, max_depth=20, min_samples_leaf=2, max_features=sqrt: 0.6744

R^2 with n_estimators=200, max_depth=20, min_samples_leaf=2, max_features=log2: 0.6686

R^2 with n_estimators=200, max_depth=20, min_samples_leaf=4, max_features=sqrt: 0.6471

R^2 with n_estimators=200, max_depth=20, min_samples_leaf=4, max_features=log2: 0.6415

R^2 with n_estimators=200, max_depth=25, min_samples_leaf=1, max_features=sqrt: 0.6953

R^2 with n_estimators=200, max_depth=25, min_samples_leaf=1, max_features=log2: 0.6903

R^2 with n_estimators=200, max_depth=25, min_samples_leaf=2, max_features=sqrt: 0.6866

R^2 with n_estimators=200, max_depth=25, min_samples_leaf=2, max_features=log2: 0.6796

R^2 with n_estimators=200, max_depth=25, min_samples_leaf=4, max_features=sqrt: 0.6563

R^2 with n_estimators=200, max_depth=25, min_samples_leaf=4, max_features=log2: 0.6474

R^2 with n_estimators=200, max_depth=30, min_samples_leaf=1, max_features=sqrt: 0.6962

R^2 with n_estimators=200, max_depth=30, min_samples_leaf=1, max_features=log2: 0.6933

R^2 with n_estimators=200, max_depth=30, min_samples_leaf=2, max_features=sqrt: 0.6852

R^2 with n_estimators=200, max_depth=30, min_samples_leaf=2, max_features=log2: 0.6804

R^2 with n_estimators=200, max_depth=30, min_samples_leaf=4, max_features=sqrt: 0.6565

R^2 with n_estimators=200, max_depth=30, min_samples_leaf=4, max_features=log2: 0.6499

R^2 with n_estimators=200, max_depth=35, min_samples_leaf=1, max_features=sqrt: 0.6967

R^2 with n_estimators=200, max_depth=35, min_samples_leaf=1, max_features=log2: 0.6914

R^2 with n_estimators=200, max_depth=35, min_samples_leaf=2, max_features=sqrt: 0.6864

R^2 with n_estimators=200, max_depth=35, min_samples_leaf=2, max_features=log2: 0.6801

R^2 with n_estimators=200, max_depth=35, min_samples_leaf=4, max_features=sqrt: 0.6571

R^2 with n_estimators=200, max_depth=35, min_samples_leaf=4, max_features=log2: 0.6487

R^2 with n_estimators=200, max_depth=40, min_samples_leaf=1, max_features=sqrt: 0.6966

R^2 with n_estimators=200, max_depth=40, min_samples_leaf=1, max_features=log2: 0.6925

R^2 with n_estimators=200, max_depth=40, min_samples_leaf=2, max_features=sqrt: 0.6873

R^2 with n_estimators=200, max_depth=40, min_samples_leaf=2, max_features=log2: 0.6801

R^2 with n_estimators=200, max_depth=40, min_samples_leaf=4, max_features=sqrt: 0.6572

R^2 with n_estimators=200, max_depth=40, min_samples_leaf=4, max_features=log2: 0.6487

R^2 with n_estimators=500, max_depth=10, min_samples_leaf=1, max_features=sqrt: 0.4578

R^2 with n_estimators=500, max_depth=10, min_samples_leaf=1, max_features=log2: 0.4360

R^2 with n_estimators=500, max_depth=10, min_samples_leaf=2, max_features=sqrt: 0.4552

R^2 with n_estimators=500, max_depth=10, min_samples_leaf=2, max_features=log2: 0.4372

R^2 with n_estimators=500, max_depth=10, min_samples_leaf=4, max_features=sqrt: 0.4502

R^2 with n_estimators=500, max_depth=10, min_samples_leaf=4, max_features=log2: 0.4286

R^2 with n_estimators=500, max_depth=15, min_samples_leaf=1, max_features=sqrt: 0.6277

R^2 with n_estimators=500, max_depth=15, min_samples_leaf=1, max_features=log2: 0.6140

R^2 with n_estimators=500, max_depth=15, min_samples_leaf=2, max_features=sqrt: 0.6229

R^2 with n_estimators=500, max_depth=15, min_samples_leaf=2, max_features=log2: 0.6056

R^2 with n_estimators=500, max_depth=15, min_samples_leaf=4, max_features=sqrt: 0.6048

R^2 with n_estimators=500, max_depth=15, min_samples_leaf=4, max_features=log2: 0.5862

R^2 with n_estimators=500, max_depth=20, min_samples_leaf=1, max_features=sqrt: 0.6873

R^2 with n_estimators=500, max_depth=20, min_samples_leaf=1, max_features=log2: 0.6782

R^2 with n_estimators=500, max_depth=20, min_samples_leaf=2, max_features=sqrt: 0.6757

R^2 with n_estimators=500, max_depth=20, min_samples_leaf=2, max_features=log2: 0.6685

R^2 with n_estimators=500, max_depth=20, min_samples_leaf=4, max_features=sqrt: 0.6496

R^2 with n_estimators=500, max_depth=20, min_samples_leaf=4, max_features=log2: 0.6402

R^2 with n_estimators=500, max_depth=25, min_samples_leaf=1, max_features=sqrt: 0.6973

R^2 with n_estimators=500, max_depth=25, min_samples_leaf=1, max_features=log2: 0.6921

R^2 with n_estimators=500, max_depth=25, min_samples_leaf=2, max_features=sqrt: 0.6868

R^2 with n_estimators=500, max_depth=25, min_samples_leaf=2, max_features=log2: 0.6806

R^2 with n_estimators=500, max_depth=25, min_samples_leaf=4, max_features=sqrt: 0.6568

R^2 with n_estimators=500, max_depth=25, min_samples_leaf=4, max_features=log2: 0.6489

R^2 with n_estimators=500, max_depth=30, min_samples_leaf=1, max_features=sqrt: 0.6987

R^2 with n_estimators=500, max_depth=30, min_samples_leaf=1, max_features=log2: 0.6945

R^2 with n_estimators=500, max_depth=30, min_samples_leaf=2, max_features=sqrt: 0.6876

R^2 with n_estimators=500, max_depth=30, min_samples_leaf=2, max_features=log2: 0.6816

R^2 with n_estimators=500, max_depth=30, min_samples_leaf=4, max_features=sqrt: 0.6569

R^2 with n_estimators=500, max_depth=30, min_samples_leaf=4, max_features=log2: 0.6501

R^2 with n_estimators=500, max_depth=35, min_samples_leaf=1, max_features=sqrt: 0.6980

R^2 with n_estimators=500, max_depth=35, min_samples_leaf=1, max_features=log2: 0.6943

R^2 with n_estimators=500, max_depth=35, min_samples_leaf=2, max_features=sqrt: 0.6874

R^2 with n_estimators=500, max_depth=35, min_samples_leaf=2, max_features=log2: 0.6806

R^2 with n_estimators=500, max_depth=35, min_samples_leaf=4, max_features=sqrt: 0.6576

R^2 with n_estimators=500, max_depth=35, min_samples_leaf=4, max_features=log2: 0.6496

R^2 with n_estimators=500, max_depth=40, min_samples_leaf=1, max_features=sqrt: 0.6971

R^2 with n_estimators=500, max_depth=40, min_samples_leaf=1, max_features=log2: 0.6950

R^2 with n_estimators=500, max_depth=40, min_samples_leaf=2, max_features=sqrt: 0.6877

R^2 with n_estimators=500, max_depth=40, min_samples_leaf=2, max_features=log2: 0.6808

R^2 with n_estimators=500, max_depth=40, min_samples_leaf=4, max_features=sqrt: 0.6578

R^2 with n_estimators=500, max_depth=40, min_samples_leaf=4, max_features=log2: 0.6496

R^2 with n_estimators=1000, max_depth=10, min_samples_leaf=1, max_features=sqrt: 0.4593

R^2 with n_estimators=1000, max_depth=10, min_samples_leaf=1, max_features=log2: 0.4364

R^2 with n_estimators=1000, max_depth=10, min_samples_leaf=2, max_features=sqrt: 0.4562

R^2 with n_estimators=1000, max_depth=10, min_samples_leaf=2, max_features=log2: 0.4348

R^2 with n_estimators=1000, max_depth=10, min_samples_leaf=4, max_features=sqrt: 0.4508

R^2 with n_estimators=1000, max_depth=10, min_samples_leaf=4, max_features=log2: 0.4284

R^2 with n_estimators=1000, max_depth=15, min_samples_leaf=1, max_features=sqrt: 0.6282

R^2 with n_estimators=1000, max_depth=15, min_samples_leaf=1, max_features=log2: 0.6139

R^2 with n_estimators=1000, max_depth=15, min_samples_leaf=2, max_features=sqrt: 0.6232

R^2 with n_estimators=1000, max_depth=15, min_samples_leaf=2, max_features=log2: 0.6063

R^2 with n_estimators=1000, max_depth=15, min_samples_leaf=4, max_features=sqrt: 0.6055

R^2 with n_estimators=1000, max_depth=15, min_samples_leaf=4, max_features=log2: 0.5871

R^2 with n_estimators=1000, max_depth=20, min_samples_leaf=1, max_features=sqrt: 0.6874

R^2 with n_estimators=1000, max_depth=20, min_samples_leaf=1, max_features=log2: 0.6771

R^2 with n_estimators=1000, max_depth=20, min_samples_leaf=2, max_features=sqrt: 0.6762

R² with n_estimators=1000, max_depth=20, min_samples_leaf=2, max_features=log2: 0.6693
R² with n_estimators=1000, max_depth=20, min_samples_leaf=4, max_features=sqrt: 0.6511
R² with n_estimators=1000, max_depth=20, min_samples_leaf=4, max_features=log2: 0.6408
R² with n_estimators=1000, max_depth=25, min_samples_leaf=1, max_features=sqrt: 0.6977
R² with n_estimators=1000, max_depth=25, min_samples_leaf=1, max_features=log2: 0.6927
R² with n_estimators=1000, max_depth=25, min_samples_leaf=2, max_features=sqrt: 0.6862
R² with n_estimators=1000, max_depth=25, min_samples_leaf=2, max_features=log2: 0.6808
R² with n_estimators=1000, max_depth=25, min_samples_leaf=4, max_features=sqrt: 0.6578
R² with n_estimators=1000, max_depth=25, min_samples_leaf=4, max_features=log2: 0.6495
R² with n_estimators=1000, max_depth=30, min_samples_leaf=1, max_features=sqrt: 0.6992
R² with n_estimators=1000, max_depth=30, min_samples_leaf=1, max_features=log2: 0.6947
R² with n_estimators=1000, max_depth=30, min_samples_leaf=2, max_features=sqrt: 0.6875
R² with n_estimators=1000, max_depth=30, min_samples_leaf=2, max_features=log2: 0.6833
R² with n_estimators=1000, max_depth=30, min_samples_leaf=4, max_features=sqrt: 0.6582
R² with n_estimators=1000, max_depth=30, min_samples_leaf=4, max_features=log2: 0.6510
R² with n_estimators=1000, max_depth=35, min_samples_leaf=1, max_features=sqrt: 0.6994
R² with n_estimators=1000, max_depth=35, min_samples_leaf=1, max_features=log2: 0.6942
R² with n_estimators=1000, max_depth=35, min_samples_leaf=2, max_features=sqrt: 0.6869
R² with n_estimators=1000, max_depth=35, min_samples_leaf=2, max_features=log2: 0.6824
R² with n_estimators=1000, max_depth=35, min_samples_leaf=4, max_features=sqrt: 0.6587
R² with n_estimators=1000, max_depth=35, min_samples_leaf=4, max_features=log2: 0.6508
R² with n_estimators=1000, max_depth=40, min_samples_leaf=1, max_features=sqrt: 0.6988
R² with n_estimators=1000, max_depth=40, min_samples_leaf=1, max_features=log2: 0.6954
R² with n_estimators=1000, max_depth=40, min_samples_leaf=2, max_features=sqrt: 0.6872
R² with n_estimators=1000, max_depth=40, min_samples_leaf=2, max_features=log2: 0.6826
R² with n_estimators=1000, max_depth=40, min_samples_leaf=4, max_features=sqrt: 0.6587
R² with n_estimators=1000, max_depth=40, min_samples_leaf=4, max_features=log2: 0.6509

Best parameters found with PCA:

{'n_estimators': 1000, 'max_depth': 35, 'min_samples_leaf': 1, 'max_features': 'sqrt'} 0.6994

1.2 RF-PCA Descriptors Loading Summary

Principal Component	Explained Variance (%)	Cumulative Variance (%)
0	6.256397034	6.256397034
1	6.156985254	12.41338229
2	4.590169043	17.00355133
3	3.903430199	20.90698153
4	3.420704615	24.32768614
5	3.225403876	27.55309002
6	2.945288712	30.49837873
7	2.561933642	33.06031238
8	2.313643773	35.37395615
9	2.190826473	37.56478262
10	2.148873282	39.7136559
11	1.919967902	41.63362381
12	1.672947571	43.30657138
13	1.616981541	44.92355292
14	1.484596313	46.40814923
15	1.46465973	47.87280896
16	1.385700944	49.25850991
17	1.344809208	50.60331911
18	1.292001199	51.89532031
19	1.236434985	53.1317553
20	1.197485075	54.32924037

21	1.167944065	55.49718444
22	1.108375841	56.60556028
23	1.085933459	57.69149374
24	1.075143007	58.76663675
25	1.036431451	59.8030682
26	1.00000472	60.80307292
27	0.977428226	61.78050114
28	0.958662157	62.7391633
29	0.944612094	63.68377539
30	0.917614671	64.60139006
31	0.908969154	65.51035922
32	0.897524151	66.40788337
33	0.881116715	67.28900008
34	0.862501484	68.15150157
35	0.85800234	69.00950391
36	0.848589563	69.85809347
37	0.842541385	70.70063486
38	0.827230657	71.52786551
39	0.821309879	72.34917539
40	0.81036412	73.15953951
41	0.801740028	73.96127954
42	0.797612028	74.75889157
43	0.788553671	75.54744524
44	0.782004453	76.32944969

45	0.762329632	77.09177932
46	0.752904778	77.8446841
47	0.740186873	78.58487097
48	0.721847832	79.30671881
49	0.718747291	80.0254661
50	0.713929958	80.73939605
51	0.689073609	81.42846966
52	0.671398781	82.09986844
53	0.659041754	82.7589102
54	0.657193436	83.41610363
55	0.650879666	84.0669833
56	0.644906299	84.7118896
57	0.617546889	85.32943649
58	0.611293178	85.94072967
59	0.599544702	86.54027437
60	0.589469091	87.12974346
61	0.558743301	87.68848676
62	0.544447761	88.23293452
63	0.536892808	88.76982733
64	0.518558848	89.28838618
65	0.512876437	89.80126261
66	0.490010709	90.29127332
67	0.470812338	90.76208566
68	0.453065467	91.21515113

69	0.446100229	91.66125136
70	0.42408913	92.08534049
71	0.418875626	92.50421611
72	0.403017082	92.90723319
73	0.368531302	93.2757645
74	0.355475842	93.63124034
75	0.346742445	93.97798278
76	0.316932146	94.29491493
77	0.310909887	94.60582482
78	0.300431221	94.90625604
79	0.293552858	95.19980889

1.3 Gradient Boosting

Testing different parameter combinations for Gradient Boosting on the normalized dataset (test set 15%)

```
param_grid_normalized = {
    'n_estimators': [10, 50, 100, 110, 150, 300, 500, 1000],
    'max_depth': [3, 5, 7, 10, 15],
    'learning_rate': [0.01, 0.05, 0.1],
    'min_samples_leaf': [1, 2, 4]
}
```

R^2

Testing different parameter combinations on the normalized dataset:

R^2 with n_estimators=10, max_depth=3, learning_rate=0.01, min_samples_leaf=1: 0.0375

R^2 with n_estimators=10, max_depth=3, learning_rate=0.01, min_samples_leaf=2: 0.0375

R^2 with n_estimators=10, max_depth=3, learning_rate=0.01, min_samples_leaf=4: 0.0375

R^2 with n_estimators=10, max_depth=3, learning_rate=0.05, min_samples_leaf=1: 0.1410

R^2 with n_estimators=10, max_depth=3, learning_rate=0.05, min_samples_leaf=2: 0.1410

R^2 with n_estimators=10, max_depth=3, learning_rate=0.05, min_samples_leaf=4: 0.1410

R^2 with n_estimators=10, max_depth=3, learning_rate=0.1, min_samples_leaf=1: 0.2132

R^2 with n_estimators=10, max_depth=3, learning_rate=0.1, min_samples_leaf=2: 0.2132

R^2 with n_estimators=10, max_depth=3, learning_rate=0.1, min_samples_leaf=4: 0.2132

R^2 with n_estimators=10, max_depth=5, learning_rate=0.01, min_samples_leaf=1: 0.0571

R^2 with n_estimators=10, max_depth=5, learning_rate=0.01, min_samples_leaf=2: 0.0571

R^2 with n_estimators=10, max_depth=5, learning_rate=0.01, min_samples_leaf=4: 0.0571

R^2 with n_estimators=10, max_depth=5, learning_rate=0.05, min_samples_leaf=1: 0.2057

R^2 with n_estimators=10, max_depth=5, learning_rate=0.05, min_samples_leaf=2: 0.2057

R^2 with n_estimators=10, max_depth=5, learning_rate=0.05, min_samples_leaf=4: 0.2057

R^2 with n_estimators=10, max_depth=5, learning_rate=0.1, min_samples_leaf=1: 0.3196

R^2 with n_estimators=10, max_depth=5, learning_rate=0.1, min_samples_leaf=2: 0.3196

R^2 with n_estimators=10, max_depth=5, learning_rate=0.1, min_samples_leaf=4: 0.3192

R^2 with n_estimators=10, max_depth=7, learning_rate=0.01, min_samples_leaf=1: 0.0796

R^2 with n_estimators=10, max_depth=7, learning_rate=0.01, min_samples_leaf=2: 0.0797

R^2 with n_estimators=10, max_depth=7, learning_rate=0.01, min_samples_leaf=4: 0.0791

R^2 with n_estimators=10, max_depth=7, learning_rate=0.05, min_samples_leaf=1: 0.2881

R^2 with n_estimators=10, max_depth=7, learning_rate=0.05, min_samples_leaf=2: 0.2898

R^2 with n_estimators=10, max_depth=7, learning_rate=0.05, min_samples_leaf=4: 0.2874

R^2 with n_estimators=10, max_depth=7, learning_rate=0.1, min_samples_leaf=1: 0.4313

R^2 with n_estimators=10, max_depth=7, learning_rate=0.1, min_samples_leaf=2: 0.4332

R^2 with n_estimators=10, max_depth=7, learning_rate=0.1, min_samples_leaf=4: 0.4370

R^2 with n_estimators=10, max_depth=10, learning_rate=0.01, min_samples_leaf=1: 0.1025

R^2 with n_estimators=10, max_depth=10, learning_rate=0.01, min_samples_leaf=2: 0.1022

R^2 with n_estimators=10, max_depth=10, learning_rate=0.01, min_samples_leaf=4: 0.1008

R^2 with n_estimators=10, max_depth=10, learning_rate=0.05, min_samples_leaf=1: 0.3879

R^2 with n_estimators=10, max_depth=10, learning_rate=0.05, min_samples_leaf=2: 0.3875

R^2 with n_estimators=10, max_depth=10, learning_rate=0.05, min_samples_leaf=4: 0.3825

R^2 with n_estimators=10, max_depth=10, learning_rate=0.1, min_samples_leaf=1: 0.5437

R^2 with n_estimators=10, max_depth=10, learning_rate=0.1, min_samples_leaf=2: 0.5536

R^2 with n_estimators=10, max_depth=10, learning_rate=0.1, min_samples_leaf=4: 0.5458

R^2 with n_estimators=10, max_depth=15, learning_rate=0.01, min_samples_leaf=1: 0.1306

R^2 with n_estimators=10, max_depth=15, learning_rate=0.01, min_samples_leaf=2: 0.1303

R^2 with n_estimators=10, max_depth=15, learning_rate=0.01, min_samples_leaf=4: 0.1258

R^2 with n_estimators=10, max_depth=15, learning_rate=0.05, min_samples_leaf=1: 0.4653

R^2 with n_estimators=10, max_depth=15, learning_rate=0.05, min_samples_leaf=2: 0.4619

R^2 with n_estimators=10, max_depth=15, learning_rate=0.05, min_samples_leaf=4: 0.4561

R^2 with n_estimators=10, max_depth=15, learning_rate=0.1, min_samples_leaf=1: 0.6382

R^2 with n_estimators=10, max_depth=15, learning_rate=0.1, min_samples_leaf=2: 0.6405

R^2 with n_estimators=10, max_depth=15, learning_rate=0.1, min_samples_leaf=4: 0.6399

R^2 with n_estimators=50, max_depth=3, learning_rate=0.01, min_samples_leaf=1: 0.1389

R^2 with n_estimators=50, max_depth=3, learning_rate=0.01, min_samples_leaf=2: 0.1389

R^2 with n_estimators=50, max_depth=3, learning_rate=0.01, min_samples_leaf=4: 0.1389

R^2 with n_estimators=50, max_depth=3, learning_rate=0.05, min_samples_leaf=1: 0.3163

R^2 with n_estimators=50, max_depth=3, learning_rate=0.05, min_samples_leaf=2: 0.3163

R^2 with n_estimators=50, max_depth=3, learning_rate=0.05, min_samples_leaf=4: 0.3163

R^2 with n_estimators=50, max_depth=3, learning_rate=0.1, min_samples_leaf=1: 0.3882

R^2 with n_estimators=50, max_depth=3, learning_rate=0.1, min_samples_leaf=2: 0.3879

R^2 with n_estimators=50, max_depth=3, learning_rate=0.1, min_samples_leaf=4: 0.3871

R^2 with n_estimators=50, max_depth=5, learning_rate=0.01, min_samples_leaf=1: 0.2061

R^2 with n_estimators=50, max_depth=5, learning_rate=0.01, min_samples_leaf=2: 0.2061

R^2 with n_estimators=50, max_depth=5, learning_rate=0.01, min_samples_leaf=4: 0.2062

R^2 with n_estimators=50, max_depth=5, learning_rate=0.05, min_samples_leaf=1: 0.4650

R^2 with n_estimators=50, max_depth=5, learning_rate=0.05, min_samples_leaf=2: 0.4697

R^2 with n_estimators=50, max_depth=5, learning_rate=0.05, min_samples_leaf=4: 0.4714

R^2 with n_estimators=50, max_depth=5, learning_rate=0.1, min_samples_leaf=1: 0.5546

R^2 with n_estimators=50, max_depth=5, learning_rate=0.1, min_samples_leaf=2: 0.5584

R^2 with n_estimators=50, max_depth=5, learning_rate=0.1, min_samples_leaf=4: 0.5518

R^2 with n_estimators=50, max_depth=7, learning_rate=0.01, min_samples_leaf=1: 0.2838

R^2 with n_estimators=50, max_depth=7, learning_rate=0.01, min_samples_leaf=2: 0.2839

R^2 with n_estimators=50, max_depth=7, learning_rate=0.01, min_samples_leaf=4: 0.2824

R^2 with n_estimators=50, max_depth=7, learning_rate=0.05, min_samples_leaf=1: 0.5978

R^2 with n_estimators=50, max_depth=7, learning_rate=0.05, min_samples_leaf=2: 0.5998

R^2 with n_estimators=50, max_depth=7, learning_rate=0.05, min_samples_leaf=4: 0.5969

R^2 with n_estimators=50, max_depth=7, learning_rate=0.1, min_samples_leaf=1: 0.6695

R^2 with n_estimators=50, max_depth=7, learning_rate=0.1, min_samples_leaf=2: 0.6671

R^2 with n_estimators=50, max_depth=7, learning_rate=0.1, min_samples_leaf=4: 0.6663

R^2 with n_estimators=50, max_depth=10, learning_rate=0.01, min_samples_leaf=1: 0.3792

R^2 with n_estimators=50, max_depth=10, learning_rate=0.01, min_samples_leaf=2: 0.3781

R^2 with n_estimators=50, max_depth=10, learning_rate=0.01, min_samples_leaf=4: 0.3750

R^2 with n_estimators=50, max_depth=10, learning_rate=0.05, min_samples_leaf=1: 0.7054

R^2 with n_estimators=50, max_depth=10, learning_rate=0.05, min_samples_leaf=2: 0.7049

R^2 with n_estimators=50, max_depth=10, learning_rate=0.05, min_samples_leaf=4: 0.7078

R^2 with n_estimators=50, max_depth=10, learning_rate=0.1, min_samples_leaf=1: 0.7571

R^2 with n_estimators=50, max_depth=10, learning_rate=0.1, min_samples_leaf=2: 0.7517

R^2 with n_estimators=50, max_depth=10, learning_rate=0.1, min_samples_leaf=4: 0.7475

R^2 with n_estimators=50, max_depth=15, learning_rate=0.01, min_samples_leaf=1: 0.4618

R^2 with n_estimators=50, max_depth=15, learning_rate=0.01, min_samples_leaf=2: 0.4572

R^2 with n_estimators=50, max_depth=15, learning_rate=0.01, min_samples_leaf=4: 0.4492

R^2 with n_estimators=50, max_depth=15, learning_rate=0.05, min_samples_leaf=1: 0.7381

R^2 with n_estimators=50, max_depth=15, learning_rate=0.05, min_samples_leaf=2: 0.7447

R^2 with n_estimators=50, max_depth=15, learning_rate=0.05, min_samples_leaf=4: 0.7526

R^2 with n_estimators=50, max_depth=15, learning_rate=0.1, min_samples_leaf=1: 0.7420

R^2 with n_estimators=50, max_depth=15, learning_rate=0.1, min_samples_leaf=2: 0.7546

R^2 with n_estimators=50, max_depth=15, learning_rate=0.1, min_samples_leaf=4: 0.7614

R^2 with n_estimators=100, max_depth=3, learning_rate=0.01, min_samples_leaf=1: 0.2090

R^2 with n_estimators=100, max_depth=3, learning_rate=0.01, min_samples_leaf=2: 0.2090

R^2 with n_estimators=100, max_depth=3, learning_rate=0.01, min_samples_leaf=4: 0.2090

R^2 with n_estimators=100, max_depth=3, learning_rate=0.05, min_samples_leaf=1: 0.3880

R^2 with n_estimators=100, max_depth=3, learning_rate=0.05, min_samples_leaf=2: 0.3876

R^2 with n_estimators=100, max_depth=3, learning_rate=0.05, min_samples_leaf=4: 0.3899

R^2 with n_estimators=100, max_depth=3, learning_rate=0.1, min_samples_leaf=1: 0.4705

R^2 with n_estimators=100, max_depth=3, learning_rate=0.1, min_samples_leaf=2: 0.4749

R^2 with n_estimators=100, max_depth=3, learning_rate=0.1, min_samples_leaf=4: 0.4690

R^2 with n_estimators=100, max_depth=5, learning_rate=0.01, min_samples_leaf=1: 0.3139

R^2 with n_estimators=100, max_depth=5, learning_rate=0.01, min_samples_leaf=2: 0.3137

R^2 with n_estimators=100, max_depth=5, learning_rate=0.01, min_samples_leaf=4: 0.3131

R^2 with n_estimators=100, max_depth=5, learning_rate=0.05, min_samples_leaf=1: 0.5532

R^2 with n_estimators=100, max_depth=5, learning_rate=0.05, min_samples_leaf=2: 0.5519

R^2 with n_estimators=100, max_depth=5, learning_rate=0.05, min_samples_leaf=4: 0.5555

R^2 with n_estimators=100, max_depth=5, learning_rate=0.1, min_samples_leaf=1: 0.6218

R^2 with n_estimators=100, max_depth=5, learning_rate=0.1, min_samples_leaf=2: 0.6198

R^2 with n_estimators=100, max_depth=5, learning_rate=0.1, min_samples_leaf=4: 0.6247

R^2 with n_estimators=100, max_depth=7, learning_rate=0.01, min_samples_leaf=1: 0.4244

R^2 with n_estimators=100, max_depth=7, learning_rate=0.01, min_samples_leaf=2: 0.4245

R^2 with n_estimators=100, max_depth=7, learning_rate=0.01, min_samples_leaf=4: 0.4233

R^2 with n_estimators=100, max_depth=7, learning_rate=0.05, min_samples_leaf=1: 0.6732

R^2 with n_estimators=100, max_depth=7, learning_rate=0.05, min_samples_leaf=2: 0.6703

R^2 with n_estimators=100, max_depth=7, learning_rate=0.05, min_samples_leaf=4: 0.6707

R^2 with n_estimators=100, max_depth=7, learning_rate=0.1, min_samples_leaf=1: 0.7172

R^2 with n_estimators=100, max_depth=7, learning_rate=0.1, min_samples_leaf=2: 0.7147

R^2 with n_estimators=100, max_depth=7, learning_rate=0.1, min_samples_leaf=4: 0.7164

R^2 with n_estimators=100, max_depth=10, learning_rate=0.01, min_samples_leaf=1: 0.5437

R^2 with n_estimators=100, max_depth=10, learning_rate=0.01, min_samples_leaf=2: 0.5468

R^2 with n_estimators=100, max_depth=10, learning_rate=0.01, min_samples_leaf=4: 0.5437

R^2 with n_estimators=100, max_depth=10, learning_rate=0.05, min_samples_leaf=1: 0.7531

R^2 with n_estimators=100, max_depth=10, learning_rate=0.05, min_samples_leaf=2: 0.7543

R^2 with n_estimators=100, max_depth=10, learning_rate=0.05, min_samples_leaf=4: 0.7575

R^2 with n_estimators=100, max_depth=10, learning_rate=0.1, min_samples_leaf=1: 0.7710

R^2 with n_estimators=100, max_depth=10, learning_rate=0.1, min_samples_leaf=2: 0.7686

R^2 with n_estimators=100, max_depth=10, learning_rate=0.1, min_samples_leaf=4: 0.7655

R^2 with n_estimators=100, max_depth=15, learning_rate=0.01, min_samples_leaf=1: 0.6357

R^2 with n_estimators=100, max_depth=15, learning_rate=0.01, min_samples_leaf=2: 0.6340

R^2 with n_estimators=100, max_depth=15, learning_rate=0.01, min_samples_leaf=4: 0.6331

R^2 with n_estimators=100, max_depth=15, learning_rate=0.05, min_samples_leaf=1: 0.7444

R^2 with n_estimators=100, max_depth=15, learning_rate=0.05, min_samples_leaf=2: 0.7544

R^2 with n_estimators=100, max_depth=15, learning_rate=0.05, min_samples_leaf=4: 0.7647

R^2 with n_estimators=100, max_depth=15, learning_rate=0.1, min_samples_leaf=1: 0.7403

R^2 with n_estimators=100, max_depth=15, learning_rate=0.1, min_samples_leaf=2: 0.7535

R^2 with n_estimators=100, max_depth=15, learning_rate=0.1, min_samples_leaf=4: 0.7612

R^2 with n_estimators=110, max_depth=3, learning_rate=0.01, min_samples_leaf=1: 0.2201

R^2 with n_estimators=110, max_depth=3, learning_rate=0.01, min_samples_leaf=2: 0.2201

R^2 with n_estimators=110, max_depth=3, learning_rate=0.01, min_samples_leaf=4: 0.2201

R^2 with n_estimators=110, max_depth=3, learning_rate=0.05, min_samples_leaf=1: 0.3989

R^2 with n_estimators=110, max_depth=3, learning_rate=0.05, min_samples_leaf=2: 0.3983

R^2 with n_estimators=110, max_depth=3, learning_rate=0.05, min_samples_leaf=4: 0.4016

R^2 with n_estimators=110, max_depth=3, learning_rate=0.1, min_samples_leaf=1: 0.4846

R^2 with n_estimators=110, max_depth=3, learning_rate=0.1, min_samples_leaf=2: 0.4844

R^2 with n_estimators=110, max_depth=3, learning_rate=0.1, min_samples_leaf=4: 0.4802

R^2 with n_estimators=110, max_depth=5, learning_rate=0.01, min_samples_leaf=1: 0.3293

R^2 with n_estimators=110, max_depth=5, learning_rate=0.01, min_samples_leaf=2: 0.3290

R^2 with n_estimators=110, max_depth=5, learning_rate=0.01, min_samples_leaf=4: 0.3288

R^2 with n_estimators=110, max_depth=5, learning_rate=0.05, min_samples_leaf=1: 0.5645

R^2 with n_estimators=110, max_depth=5, learning_rate=0.05, min_samples_leaf=2: 0.5622

R^2 with n_estimators=110, max_depth=5, learning_rate=0.05, min_samples_leaf=4: 0.5653

R^2 with n_estimators=110, max_depth=5, learning_rate=0.1, min_samples_leaf=1: 0.6284

R^2 with n_estimators=110, max_depth=5, learning_rate=0.1, min_samples_leaf=2: 0.6302

R^2 with n_estimators=110, max_depth=5, learning_rate=0.1, min_samples_leaf=4: 0.6333

R^2 with n_estimators=110, max_depth=7, learning_rate=0.01, min_samples_leaf=1: 0.4453

R^2 with n_estimators=110, max_depth=7, learning_rate=0.01, min_samples_leaf=2: 0.4457

R^2 with n_estimators=110, max_depth=7, learning_rate=0.01, min_samples_leaf=4: 0.4436

R^2 with n_estimators=110, max_depth=7, learning_rate=0.05, min_samples_leaf=1: 0.6809

R^2 with n_estimators=110, max_depth=7, learning_rate=0.05, min_samples_leaf=2: 0.6774

R^2 with n_estimators=110, max_depth=7, learning_rate=0.05, min_samples_leaf=4: 0.6789

R^2 with n_estimators=110, max_depth=7, learning_rate=0.1, min_samples_leaf=1: 0.7214

R^2 with n_estimators=110, max_depth=7, learning_rate=0.1, min_samples_leaf=2: 0.7220

R^2 with n_estimators=110, max_depth=7, learning_rate=0.1, min_samples_leaf=4: 0.7203

R^2 with n_estimators=110, max_depth=10, learning_rate=0.01, min_samples_leaf=1: 0.5653

R^2 with n_estimators=110, max_depth=10, learning_rate=0.01, min_samples_leaf=2: 0.5688

R^2 with n_estimators=110, max_depth=10, learning_rate=0.01, min_samples_leaf=4: 0.5641

R^2 with n_estimators=110, max_depth=10, learning_rate=0.05, min_samples_leaf=1: 0.7571

R^2 with n_estimators=110, max_depth=10, learning_rate=0.05, min_samples_leaf=2: 0.7570

R^2 with n_estimators=110, max_depth=10, learning_rate=0.05, min_samples_leaf=4: 0.7607

R^2 with n_estimators=110, max_depth=10, learning_rate=0.1, min_samples_leaf=1: 0.7722

R^2 with n_estimators=110, max_depth=10, learning_rate=0.1, min_samples_leaf=2: 0.7701

R^2 with n_estimators=110, max_depth=10, learning_rate=0.1, min_samples_leaf=4: 0.7667

R^2 with n_estimators=110, max_depth=15, learning_rate=0.01, min_samples_leaf=1: 0.6546

R^2 with n_estimators=110, max_depth=15, learning_rate=0.01, min_samples_leaf=2: 0.6533

R^2 with n_estimators=110, max_depth=15, learning_rate=0.01, min_samples_leaf=4: 0.6532

R^2 with n_estimators=110, max_depth=15, learning_rate=0.05, min_samples_leaf=1: 0.7439

R^2 with n_estimators=110, max_depth=15, learning_rate=0.05, min_samples_leaf=2: 0.7541

R^2 with n_estimators=110, max_depth=15, learning_rate=0.05, min_samples_leaf=4: 0.7651

R^2 with n_estimators=110, max_depth=15, learning_rate=0.1, min_samples_leaf=1: 0.7402

R^2 with n_estimators=110, max_depth=15, learning_rate=0.1, min_samples_leaf=2: 0.7533

R^2 with n_estimators=110, max_depth=15, learning_rate=0.1, min_samples_leaf=4: 0.7609

R^2 with n_estimators=150, max_depth=3, learning_rate=0.01, min_samples_leaf=1: 0.2572

R^2 with n_estimators=150, max_depth=3, learning_rate=0.01, min_samples_leaf=2: 0.2572

R^2 with n_estimators=150, max_depth=3, learning_rate=0.01, min_samples_leaf=4: 0.2572

R^2 with n_estimators=150, max_depth=3, learning_rate=0.05, min_samples_leaf=1: 0.4346

R^2 with n_estimators=150, max_depth=3, learning_rate=0.05, min_samples_leaf=2: 0.4344

R^2 with n_estimators=150, max_depth=3, learning_rate=0.05, min_samples_leaf=4: 0.4388

R^2 with n_estimators=150, max_depth=3, learning_rate=0.1, min_samples_leaf=1: 0.5175

R^2 with n_estimators=150, max_depth=3, learning_rate=0.1, min_samples_leaf=2: 0.5179

R^2 with n_estimators=150, max_depth=3, learning_rate=0.1, min_samples_leaf=4: 0.5123

R^2 with n_estimators=150, max_depth=5, learning_rate=0.01, min_samples_leaf=1: 0.3821

R^2 with n_estimators=150, max_depth=5, learning_rate=0.01, min_samples_leaf=2: 0.3827

R^2 with n_estimators=150, max_depth=5, learning_rate=0.01, min_samples_leaf=4: 0.3816

R^2 with n_estimators=150, max_depth=5, learning_rate=0.05, min_samples_leaf=1: 0.5943

R^2 with n_estimators=150, max_depth=5, learning_rate=0.05, min_samples_leaf=2: 0.5914

R^2 with n_estimators=150, max_depth=5, learning_rate=0.05, min_samples_leaf=4: 0.5941

R^2 with n_estimators=150, max_depth=5, learning_rate=0.1, min_samples_leaf=1: 0.6539

R^2 with n_estimators=150, max_depth=5, learning_rate=0.1, min_samples_leaf=2: 0.6619

R^2 with n_estimators=150, max_depth=5, learning_rate=0.1, min_samples_leaf=4: 0.6616

R^2 with n_estimators=150, max_depth=7, learning_rate=0.01, min_samples_leaf=1: 0.5041

R^2 with n_estimators=150, max_depth=7, learning_rate=0.01, min_samples_leaf=2: 0.5045

R^2 with n_estimators=150, max_depth=7, learning_rate=0.01, min_samples_leaf=4: 0.5020

R^2 with n_estimators=150, max_depth=7, learning_rate=0.05, min_samples_leaf=1: 0.7053

R^2 with n_estimators=150, max_depth=7, learning_rate=0.05, min_samples_leaf=2: 0.6993

R^2 with n_estimators=150, max_depth=7, learning_rate=0.05, min_samples_leaf=4: 0.7005

R^2 with n_estimators=150, max_depth=7, learning_rate=0.1, min_samples_leaf=1: 0.7376

R^2 with n_estimators=150, max_depth=7, learning_rate=0.1, min_samples_leaf=2: 0.7397

R^2 with n_estimators=150, max_depth=7, learning_rate=0.1, min_samples_leaf=4: 0.7400

R^2 with n_estimators=150, max_depth=10, learning_rate=0.01, min_samples_leaf=1: 0.6314

R^2 with n_estimators=150, max_depth=10, learning_rate=0.01, min_samples_leaf=2: 0.6335

R^2 with n_estimators=150, max_depth=10, learning_rate=0.01, min_samples_leaf=4: 0.6263

R^2 with n_estimators=150, max_depth=10, learning_rate=0.05, min_samples_leaf=1: 0.7637

R^2 with n_estimators=150, max_depth=10, learning_rate=0.05, min_samples_leaf=2: 0.7642

R^2 with n_estimators=150, max_depth=10, learning_rate=0.05, min_samples_leaf=4: 0.7692

R^2 with n_estimators=150, max_depth=10, learning_rate=0.1, min_samples_leaf=1: 0.7742

R^2 with n_estimators=150, max_depth=10, learning_rate=0.1, min_samples_leaf=2: 0.7724

R^2 with n_estimators=150, max_depth=10, learning_rate=0.1, min_samples_leaf=4: 0.7711

R^2 with n_estimators=150, max_depth=15, learning_rate=0.01, min_samples_leaf=1: 0.7033

R^2 with n_estimators=150, max_depth=15, learning_rate=0.01, min_samples_leaf=2: 0.7039

R^2 with n_estimators=150, max_depth=15, learning_rate=0.01, min_samples_leaf=4: 0.7063

R^2 with n_estimators=150, max_depth=15, learning_rate=0.05, min_samples_leaf=1: 0.7427

R^2 with n_estimators=150, max_depth=15, learning_rate=0.05, min_samples_leaf=2: 0.7535

R^2 with n_estimators=150, max_depth=15, learning_rate=0.05, min_samples_leaf=4: 0.7651

R^2 with n_estimators=150, max_depth=15, learning_rate=0.1, min_samples_leaf=1: 0.7400

R^2 with n_estimators=150, max_depth=15, learning_rate=0.1, min_samples_leaf=2: 0.7527

R^2 with n_estimators=150, max_depth=15, learning_rate=0.1, min_samples_leaf=4: 0.7603

R^2 with n_estimators=300, max_depth=3, learning_rate=0.01, min_samples_leaf=1: 0.3359

R^2 with n_estimators=300, max_depth=3, learning_rate=0.01, min_samples_leaf=2: 0.3359

R^2 with n_estimators=300, max_depth=3, learning_rate=0.01, min_samples_leaf=4: 0.3359

R^2 with n_estimators=300, max_depth=3, learning_rate=0.05, min_samples_leaf=1: 0.5160

R^2 with n_estimators=300, max_depth=3, learning_rate=0.05, min_samples_leaf=2: 0.5149

R^2 with n_estimators=300, max_depth=3, learning_rate=0.05, min_samples_leaf=4: 0.5175

R^2 with n_estimators=300, max_depth=3, learning_rate=0.1, min_samples_leaf=1: 0.5897

R^2 with n_estimators=300, max_depth=3, learning_rate=0.1, min_samples_leaf=2: 0.5894

R^2 with n_estimators=300, max_depth=3, learning_rate=0.1, min_samples_leaf=4: 0.5863

R^2 with n_estimators=300, max_depth=5, learning_rate=0.01, min_samples_leaf=1: 0.4918

R^2 with n_estimators=300, max_depth=5, learning_rate=0.01, min_samples_leaf=2: 0.4931

R^2 with n_estimators=300, max_depth=5, learning_rate=0.01, min_samples_leaf=4: 0.4915

R^2 with n_estimators=300, max_depth=5, learning_rate=0.05, min_samples_leaf=1: 0.6612

R^2 with n_estimators=300, max_depth=5, learning_rate=0.05, min_samples_leaf=2: 0.6622

R^2 with n_estimators=300, max_depth=5, learning_rate=0.05, min_samples_leaf=4: 0.6614

R^2 with n_estimators=300, max_depth=5, learning_rate=0.1, min_samples_leaf=1: 0.7157

R^2 with n_estimators=300, max_depth=5, learning_rate=0.1, min_samples_leaf=2: 0.7146

R^2 with n_estimators=300, max_depth=5, learning_rate=0.1, min_samples_leaf=4: 0.7149

R^2 with n_estimators=300, max_depth=7, learning_rate=0.01, min_samples_leaf=1: 0.6209

R^2 with n_estimators=300, max_depth=7, learning_rate=0.01, min_samples_leaf=2: 0.6184

R^2 with n_estimators=300, max_depth=7, learning_rate=0.01, min_samples_leaf=4: 0.6204

R^2 with n_estimators=300, max_depth=7, learning_rate=0.05, min_samples_leaf=1: 0.7428

R^2 with n_estimators=300, max_depth=7, learning_rate=0.05, min_samples_leaf=2: 0.7433

R^2 with n_estimators=300, max_depth=7, learning_rate=0.05, min_samples_leaf=4: 0.7419

R^2 with n_estimators=300, max_depth=7, learning_rate=0.1, min_samples_leaf=1: 0.7619

R^2 with n_estimators=300, max_depth=7, learning_rate=0.1, min_samples_leaf=2: 0.7667

R^2 with n_estimators=300, max_depth=7, learning_rate=0.1, min_samples_leaf=4: 0.7677

R^2 with n_estimators=300, max_depth=10, learning_rate=0.01, min_samples_leaf=1: 0.7241

R^2 with n_estimators=300, max_depth=10, learning_rate=0.01, min_samples_leaf=2: 0.7247

R^2 with n_estimators=300, max_depth=10, learning_rate=0.01, min_samples_leaf=4: 0.7210

R^2 with n_estimators=300, max_depth=10, learning_rate=0.05, min_samples_leaf=1: 0.7709

R^2 with n_estimators=300, max_depth=10, learning_rate=0.05, min_samples_leaf=2: 0.7733

R^2 with n_estimators=300, max_depth=10, learning_rate=0.05, min_samples_leaf=4: 0.7782

R^2 with n_estimators=300, max_depth=10, learning_rate=0.1, min_samples_leaf=1: 0.7764

R^2 with n_estimators=300, max_depth=10, learning_rate=0.1, min_samples_leaf=2: 0.7749

R^2 with n_estimators=300, max_depth=10, learning_rate=0.1, min_samples_leaf=4: 0.7735
R^2 with n_estimators=300, max_depth=15, learning_rate=0.01, min_samples_leaf=1: 0.7450
R^2 with n_estimators=300, max_depth=15, learning_rate=0.01, min_samples_leaf=2: 0.7524
R^2 with n_estimators=300, max_depth=15, learning_rate=0.01, min_samples_leaf=4: 0.7599
R^2 with n_estimators=300, max_depth=15, learning_rate=0.05, min_samples_leaf=1: 0.7419
R^2 with n_estimators=300, max_depth=15, learning_rate=0.05, min_samples_leaf=2: 0.7521
R^2 with n_estimators=300, max_depth=15, learning_rate=0.05, min_samples_leaf=4: 0.7645
R^2 with n_estimators=300, max_depth=15, learning_rate=0.1, min_samples_leaf=1: 0.7398
R^2 with n_estimators=300, max_depth=15, learning_rate=0.1, min_samples_leaf=2: 0.7519
R^2 with n_estimators=300, max_depth=15, learning_rate=0.1, min_samples_leaf=4: 0.7581
R^2 with n_estimators=500, max_depth=3, learning_rate=0.01, min_samples_leaf=1: 0.3887
R^2 with n_estimators=500, max_depth=3, learning_rate=0.01, min_samples_leaf=2: 0.3893
R^2 with n_estimators=500, max_depth=3, learning_rate=0.01, min_samples_leaf=4: 0.3891
R^2 with n_estimators=500, max_depth=3, learning_rate=0.05, min_samples_leaf=1: 0.5712
R^2 with n_estimators=500, max_depth=3, learning_rate=0.05, min_samples_leaf=2: 0.5741
R^2 with n_estimators=500, max_depth=3, learning_rate=0.05, min_samples_leaf=4: 0.5740
R^2 with n_estimators=500, max_depth=3, learning_rate=0.1, min_samples_leaf=1: 0.6362
R^2 with n_estimators=500, max_depth=3, learning_rate=0.1, min_samples_leaf=2: 0.6336
R^2 with n_estimators=500, max_depth=3, learning_rate=0.1, min_samples_leaf=4: 0.6340
R^2 with n_estimators=500, max_depth=5, learning_rate=0.01, min_samples_leaf=1: 0.5507
R^2 with n_estimators=500, max_depth=5, learning_rate=0.01, min_samples_leaf=2: 0.5519
R^2 with n_estimators=500, max_depth=5, learning_rate=0.01, min_samples_leaf=4: 0.5521
R^2 with n_estimators=500, max_depth=5, learning_rate=0.05, min_samples_leaf=1: 0.7023
R^2 with n_estimators=500, max_depth=5, learning_rate=0.05, min_samples_leaf=2: 0.7061
R^2 with n_estimators=500, max_depth=5, learning_rate=0.05, min_samples_leaf=4: 0.7029
R^2 with n_estimators=500, max_depth=5, learning_rate=0.1, min_samples_leaf=1: 0.7459
R^2 with n_estimators=500, max_depth=5, learning_rate=0.1, min_samples_leaf=2: 0.7456
R^2 with n_estimators=500, max_depth=5, learning_rate=0.1, min_samples_leaf=4: 0.7420
R^2 with n_estimators=500, max_depth=7, learning_rate=0.01, min_samples_leaf=1: 0.6718
R^2 with n_estimators=500, max_depth=7, learning_rate=0.01, min_samples_leaf=2: 0.6707
R^2 with n_estimators=500, max_depth=7, learning_rate=0.01, min_samples_leaf=4: 0.6715
R^2 with n_estimators=500, max_depth=7, learning_rate=0.05, min_samples_leaf=1: 0.7611

R^2 with n_estimators=500, max_depth=7, learning_rate=0.05, min_samples_leaf=2: 0.7635
R^2 with n_estimators=500, max_depth=7, learning_rate=0.05, min_samples_leaf=4: 0.7618
R^2 with n_estimators=500, max_depth=7, learning_rate=0.1, min_samples_leaf=1: 0.7707
R^2 with n_estimators=500, max_depth=7, learning_rate=0.1, min_samples_leaf=2: 0.7756
R^2 with n_estimators=500, max_depth=7, learning_rate=0.1, min_samples_leaf=4: 0.7775
R^2 with n_estimators=500, max_depth=10, learning_rate=0.01, min_samples_leaf=1: 0.7548
R^2 with n_estimators=500, max_depth=10, learning_rate=0.01, min_samples_leaf=2: 0.7559
R^2 with n_estimators=500, max_depth=10, learning_rate=0.01, min_samples_leaf=4: 0.7500
R^2 with n_estimators=500, max_depth=10, learning_rate=0.05, min_samples_leaf=1: 0.7725
R^2 with n_estimators=500, max_depth=10, learning_rate=0.05, min_samples_leaf=2: 0.7745
R^2 with n_estimators=500, max_depth=10, learning_rate=0.05, min_samples_leaf=4: 0.7798
R^2 with n_estimators=500, max_depth=10, learning_rate=0.1, min_samples_leaf=1: 0.7748
R^2 with n_estimators=500, max_depth=10, learning_rate=0.1, min_samples_leaf=2: 0.7732
R^2 with n_estimators=500, max_depth=10, learning_rate=0.1, min_samples_leaf=4: 0.7729
R^2 with n_estimators=500, max_depth=15, learning_rate=0.01, min_samples_leaf=1: 0.7478
R^2 with n_estimators=500, max_depth=15, learning_rate=0.01, min_samples_leaf=2: 0.7562
R^2 with n_estimators=500, max_depth=15, learning_rate=0.01, min_samples_leaf=4: 0.7662
R^2 with n_estimators=500, max_depth=15, learning_rate=0.05, min_samples_leaf=1: 0.7417
R^2 with n_estimators=500, max_depth=15, learning_rate=0.05, min_samples_leaf=2: 0.7513
R^2 with n_estimators=500, max_depth=15, learning_rate=0.05, min_samples_leaf=4: 0.7631
R^2 with n_estimators=500, max_depth=15, learning_rate=0.1, min_samples_leaf=1: 0.7398
R^2 with n_estimators=500, max_depth=15, learning_rate=0.1, min_samples_leaf=2: 0.7517
R^2 with n_estimators=500, max_depth=15, learning_rate=0.1, min_samples_leaf=4: 0.7572
R^2 with n_estimators=1000, max_depth=3, learning_rate=0.01, min_samples_leaf=1: 0.4709
R^2 with n_estimators=1000, max_depth=3, learning_rate=0.01, min_samples_leaf=2: 0.4725
R^2 with n_estimators=1000, max_depth=3, learning_rate=0.01, min_samples_leaf=4: 0.4722
R^2 with n_estimators=1000, max_depth=3, learning_rate=0.05, min_samples_leaf=1: 0.6378
R^2 with n_estimators=1000, max_depth=3, learning_rate=0.05, min_samples_leaf=2: 0.6384
R^2 with n_estimators=1000, max_depth=3, learning_rate=0.05, min_samples_leaf=4: 0.6386
R^2 with n_estimators=1000, max_depth=3, learning_rate=0.1, min_samples_leaf=1: 0.6910
R^2 with n_estimators=1000, max_depth=3, learning_rate=0.1, min_samples_leaf=2: 0.6893
R^2 with n_estimators=1000, max_depth=3, learning_rate=0.1, min_samples_leaf=4: 0.6904

R^2 with n_estimators=1000, max_depth=5, learning_rate=0.01, min_samples_leaf=1: 0.6190

R^2 with n_estimators=1000, max_depth=5, learning_rate=0.01, min_samples_leaf=2: 0.6189

R^2 with n_estimators=1000, max_depth=5, learning_rate=0.01, min_samples_leaf=4: 0.6181

R^2 with n_estimators=1000, max_depth=5, learning_rate=0.05, min_samples_leaf=1: 0.7447

R^2 with n_estimators=1000, max_depth=5, learning_rate=0.05, min_samples_leaf=2: 0.7488

R^2 with n_estimators=1000, max_depth=5, learning_rate=0.05, min_samples_leaf=4: 0.7454

R^2 with n_estimators=1000, max_depth=5, learning_rate=0.1, min_samples_leaf=1: 0.7665

R^2 with n_estimators=1000, max_depth=5, learning_rate=0.1, min_samples_leaf=2: 0.7685

R^2 with n_estimators=1000, max_depth=5, learning_rate=0.1, min_samples_leaf=4: 0.7677

R^2 with n_estimators=1000, max_depth=7, learning_rate=0.01, min_samples_leaf=1: 0.7216

R^2 with n_estimators=1000, max_depth=7, learning_rate=0.01, min_samples_leaf=2: 0.7220

R^2 with n_estimators=1000, max_depth=7, learning_rate=0.01, min_samples_leaf=4: 0.7219

R^2 with n_estimators=1000, max_depth=7, learning_rate=0.05, min_samples_leaf=1: 0.7767

R^2 with n_estimators=1000, max_depth=7, learning_rate=0.05, min_samples_leaf=2: 0.7780

R^2 with n_estimators=1000, max_depth=7, learning_rate=0.05, min_samples_leaf=4: 0.7761

R^2 with n_estimators=1000, max_depth=7, learning_rate=0.1, min_samples_leaf=1: 0.7729

R^2 with n_estimators=1000, max_depth=7, learning_rate=0.1, min_samples_leaf=2: 0.7773

R^2 with n_estimators=1000, max_depth=7, learning_rate=0.1, min_samples_leaf=4: 0.7808

R^2 with n_estimators=1000, max_depth=10, learning_rate=0.01, min_samples_leaf=1: 0.7693

R^2 with n_estimators=1000, max_depth=10, learning_rate=0.01, min_samples_leaf=2: 0.7713

R^2 with n_estimators=1000, max_depth=10, learning_rate=0.01, min_samples_leaf=4: 0.7669

R^2 with n_estimators=1000, max_depth=10, learning_rate=0.05, min_samples_leaf=1: 0.7715

R^2 with n_estimators=1000, max_depth=10, learning_rate=0.05, min_samples_leaf=2: 0.7731

R^2 with n_estimators=1000, max_depth=10, learning_rate=0.05, min_samples_leaf=4: 0.7796

R^2 with n_estimators=1000, max_depth=10, learning_rate=0.1, min_samples_leaf=1: 0.7737

R^2 with n_estimators=1000, max_depth=10, learning_rate=0.1, min_samples_leaf=2: 0.7718

R^2 with n_estimators=1000, max_depth=10, learning_rate=0.1, min_samples_leaf=4: 0.7709

R^2 with n_estimators=1000, max_depth=15, learning_rate=0.01, min_samples_leaf=1: 0.7465

R^2 with n_estimators=1000, max_depth=15, learning_rate=0.01, min_samples_leaf=2: 0.7548

R^2 with n_estimators=1000, max_depth=15, learning_rate=0.01, min_samples_leaf=4: 0.7664

R^2 with n_estimators=1000, max_depth=15, learning_rate=0.05, min_samples_leaf=1: 0.7416

R^2 with n_estimators=1000, max_depth=15, learning_rate=0.05, min_samples_leaf=2: 0.7510

R² with n_estimators=1000, max_depth=15, learning_rate=0.05, min_samples_leaf=4: 0.7615

R² with n_estimators=1000, max_depth=15, learning_rate=0.1, min_samples_leaf=1: 0.7398

R² with n_estimators=1000, max_depth=15, learning_rate=0.1, min_samples_leaf=2: 0.7517

R² with n_estimators=1000, max_depth=15, learning_rate=0.1, min_samples_leaf=4: 0.7569

Best parameters found on the normalized dataset:

{'n_estimators': 1000, 'max_depth': 7, 'learning_rate': 0.1, 'min_samples_leaf': 4} 0.7808

1.4 XGBoost

Testing different parameter combinations for XGBoost on the normalized dataset (15% test set)

```
param_grid_normalized = {
    'n_estimators': [10, 50, 100, 110, 150, 300, 500, 1000],
    'max_depth': [3, 5, 7, 10, 15],
    'learning_rate': [0.01, 0.05, 0.1],
    'min_child_weight': [1, 2, 4]
}
```

Testing different parameter combinations on the normalized dataset:

R²

R² with n_estimators=10, max_depth=3, learning_rate=0.01, min_child_weight=1: 0.0375

R² with n_estimators=10, max_depth=3, learning_rate=0.01, min_child_weight=2: 0.0375

R² with n_estimators=10, max_depth=3, learning_rate=0.01, min_child_weight=4: 0.0375

R² with n_estimators=10, max_depth=3, learning_rate=0.05, min_child_weight=1: 0.1418

R² with n_estimators=10, max_depth=3, learning_rate=0.05, min_child_weight=2: 0.1418

R² with n_estimators=10, max_depth=3, learning_rate=0.05, min_child_weight=4: 0.1418

R² with n_estimators=10, max_depth=3, learning_rate=0.1, min_child_weight=1: 0.2137

R² with n_estimators=10, max_depth=3, learning_rate=0.1, min_child_weight=2: 0.2137

R² with n_estimators=10, max_depth=3, learning_rate=0.1, min_child_weight=4: 0.2137

R² with n_estimators=10, max_depth=5, learning_rate=0.01, min_child_weight=1: 0.0575

R² with n_estimators=10, max_depth=5, learning_rate=0.01, min_child_weight=2: 0.0575

R^2 with n_estimators=10, max_depth=5, learning_rate=0.01, min_child_weight=4: 0.0574

R^2 with n_estimators=10, max_depth=5, learning_rate=0.05, min_child_weight=1: 0.2107

R^2 with n_estimators=10, max_depth=5, learning_rate=0.05, min_child_weight=2: 0.2106

R^2 with n_estimators=10, max_depth=5, learning_rate=0.05, min_child_weight=4: 0.2109

R^2 with n_estimators=10, max_depth=5, learning_rate=0.1, min_child_weight=1: 0.3215

R^2 with n_estimators=10, max_depth=5, learning_rate=0.1, min_child_weight=2: 0.3205

R^2 with n_estimators=10, max_depth=5, learning_rate=0.1, min_child_weight=4: 0.3204

R^2 with n_estimators=10, max_depth=7, learning_rate=0.01, min_child_weight=1: 0.0798

R^2 with n_estimators=10, max_depth=7, learning_rate=0.01, min_child_weight=2: 0.0798

R^2 with n_estimators=10, max_depth=7, learning_rate=0.01, min_child_weight=4: 0.0790

R^2 with n_estimators=10, max_depth=7, learning_rate=0.05, min_child_weight=1: 0.2909

R^2 with n_estimators=10, max_depth=7, learning_rate=0.05, min_child_weight=2: 0.2904

R^2 with n_estimators=10, max_depth=7, learning_rate=0.05, min_child_weight=4: 0.2891

R^2 with n_estimators=10, max_depth=7, learning_rate=0.1, min_child_weight=1: 0.4315

R^2 with n_estimators=10, max_depth=7, learning_rate=0.1, min_child_weight=2: 0.4329

R^2 with n_estimators=10, max_depth=7, learning_rate=0.1, min_child_weight=4: 0.4332

R^2 with n_estimators=10, max_depth=10, learning_rate=0.01, min_child_weight=1: 0.1015

R^2 with n_estimators=10, max_depth=10, learning_rate=0.01, min_child_weight=2: 0.1016

R^2 with n_estimators=10, max_depth=10, learning_rate=0.01, min_child_weight=4: 0.1003

R^2 with n_estimators=10, max_depth=10, learning_rate=0.05, min_child_weight=1: 0.3767

R^2 with n_estimators=10, max_depth=10, learning_rate=0.05, min_child_weight=2: 0.3764

R^2 with n_estimators=10, max_depth=10, learning_rate=0.05, min_child_weight=4: 0.3731

R^2 with n_estimators=10, max_depth=10, learning_rate=0.1, min_child_weight=1: 0.5472

R^2 with n_estimators=10, max_depth=10, learning_rate=0.1, min_child_weight=2: 0.5512

R^2 with n_estimators=10, max_depth=10, learning_rate=0.1, min_child_weight=4: 0.5474

R^2 with n_estimators=10, max_depth=15, learning_rate=0.01, min_child_weight=1: 0.1189

R^2 with n_estimators=10, max_depth=15, learning_rate=0.01, min_child_weight=2: 0.1189

R^2 with n_estimators=10, max_depth=15, learning_rate=0.01, min_child_weight=4: 0.1172

R^2 with n_estimators=10, max_depth=15, learning_rate=0.05, min_child_weight=1: 0.4408

R^2 with n_estimators=10, max_depth=15, learning_rate=0.05, min_child_weight=2: 0.4400

R^2 with n_estimators=10, max_depth=15, learning_rate=0.05, min_child_weight=4: 0.4334

R^2 with n_estimators=10, max_depth=15, learning_rate=0.1, min_child_weight=1: 0.6217

R^2 with n_estimators=10, max_depth=15, learning_rate=0.1, min_child_weight=2: 0.6231

R^2 with n_estimators=10, max_depth=15, learning_rate=0.1, min_child_weight=4: 0.6144

R^2 with n_estimators=50, max_depth=3, learning_rate=0.01, min_child_weight=1: 0.1397

R^2 with n_estimators=50, max_depth=3, learning_rate=0.01, min_child_weight=2: 0.1397

R^2 with n_estimators=50, max_depth=3, learning_rate=0.01, min_child_weight=4: 0.1397

R^2 with n_estimators=50, max_depth=3, learning_rate=0.05, min_child_weight=1: 0.3186

R^2 with n_estimators=50, max_depth=3, learning_rate=0.05, min_child_weight=2: 0.3186

R^2 with n_estimators=50, max_depth=3, learning_rate=0.05, min_child_weight=4: 0.3186

R^2 with n_estimators=50, max_depth=3, learning_rate=0.1, min_child_weight=1: 0.3885

R^2 with n_estimators=50, max_depth=3, learning_rate=0.1, min_child_weight=2: 0.3885

R^2 with n_estimators=50, max_depth=3, learning_rate=0.1, min_child_weight=4: 0.3884

R^2 with n_estimators=50, max_depth=5, learning_rate=0.01, min_child_weight=1: 0.2074

R^2 with n_estimators=50, max_depth=5, learning_rate=0.01, min_child_weight=2: 0.2074

R^2 with n_estimators=50, max_depth=5, learning_rate=0.01, min_child_weight=4: 0.2075

R^2 with n_estimators=50, max_depth=5, learning_rate=0.05, min_child_weight=1: 0.4695

R^2 with n_estimators=50, max_depth=5, learning_rate=0.05, min_child_weight=2: 0.4694

R^2 with n_estimators=50, max_depth=5, learning_rate=0.05, min_child_weight=4: 0.4725

R^2 with n_estimators=50, max_depth=5, learning_rate=0.1, min_child_weight=1: 0.5505

R^2 with n_estimators=50, max_depth=5, learning_rate=0.1, min_child_weight=2: 0.5478

R^2 with n_estimators=50, max_depth=5, learning_rate=0.1, min_child_weight=4: 0.5503

R^2 with n_estimators=50, max_depth=7, learning_rate=0.01, min_child_weight=1: 0.2867

R^2 with n_estimators=50, max_depth=7, learning_rate=0.01, min_child_weight=2: 0.2889

R^2 with n_estimators=50, max_depth=7, learning_rate=0.01, min_child_weight=4: 0.2880

R^2 with n_estimators=50, max_depth=7, learning_rate=0.05, min_child_weight=1: 0.5925

R^2 with n_estimators=50, max_depth=7, learning_rate=0.05, min_child_weight=2: 0.5935

R^2 with n_estimators=50, max_depth=7, learning_rate=0.05, min_child_weight=4: 0.5865

R^2 with n_estimators=50, max_depth=7, learning_rate=0.1, min_child_weight=1: 0.6655

R^2 with n_estimators=50, max_depth=7, learning_rate=0.1, min_child_weight=2: 0.6643

R^2 with n_estimators=50, max_depth=7, learning_rate=0.1, min_child_weight=4: 0.6600

R^2 with n_estimators=50, max_depth=10, learning_rate=0.01, min_child_weight=1: 0.3733

R^2 with n_estimators=50, max_depth=10, learning_rate=0.01, min_child_weight=2: 0.3729

R^2 with n_estimators=50, max_depth=10, learning_rate=0.01, min_child_weight=4: 0.3702

R^2 with n_estimators=50, max_depth=10, learning_rate=0.05, min_child_weight=1: 0.7004

R^2 with n_estimators=50, max_depth=10, learning_rate=0.05, min_child_weight=2: 0.6996

R^2 with n_estimators=50, max_depth=10, learning_rate=0.05, min_child_weight=4: 0.6970

R^2 with n_estimators=50, max_depth=10, learning_rate=0.1, min_child_weight=1: 0.7482

R^2 with n_estimators=50, max_depth=10, learning_rate=0.1, min_child_weight=2: 0.7468

R^2 with n_estimators=50, max_depth=10, learning_rate=0.1, min_child_weight=4: 0.7488

R^2 with n_estimators=50, max_depth=15, learning_rate=0.01, min_child_weight=1: 0.4347

R^2 with n_estimators=50, max_depth=15, learning_rate=0.01, min_child_weight=2: 0.4338

R^2 with n_estimators=50, max_depth=15, learning_rate=0.01, min_child_weight=4: 0.4273

R^2 with n_estimators=50, max_depth=15, learning_rate=0.05, min_child_weight=1: 0.7474

R^2 with n_estimators=50, max_depth=15, learning_rate=0.05, min_child_weight=2: 0.7489

R^2 with n_estimators=50, max_depth=15, learning_rate=0.05, min_child_weight=4: 0.7438

R^2 with n_estimators=50, max_depth=15, learning_rate=0.1, min_child_weight=1: 0.7562

R^2 with n_estimators=50, max_depth=15, learning_rate=0.1, min_child_weight=2: 0.7615

R^2 with n_estimators=50, max_depth=15, learning_rate=0.1, min_child_weight=4: 0.7586

R^2 with n_estimators=100, max_depth=3, learning_rate=0.01, min_child_weight=1: 0.2122

R^2 with n_estimators=100, max_depth=3, learning_rate=0.01, min_child_weight=2: 0.2122

R^2 with n_estimators=100, max_depth=3, learning_rate=0.01, min_child_weight=4: 0.2122

R^2 with n_estimators=100, max_depth=3, learning_rate=0.05, min_child_weight=1: 0.3904

R^2 with n_estimators=100, max_depth=3, learning_rate=0.05, min_child_weight=2: 0.3904

R^2 with n_estimators=100, max_depth=3, learning_rate=0.05, min_child_weight=4: 0.3903

R^2 with n_estimators=100, max_depth=3, learning_rate=0.1, min_child_weight=1: 0.4677

R^2 with n_estimators=100, max_depth=3, learning_rate=0.1, min_child_weight=2: 0.4677

R^2 with n_estimators=100, max_depth=3, learning_rate=0.1, min_child_weight=4: 0.4679

R^2 with n_estimators=100, max_depth=5, learning_rate=0.01, min_child_weight=1: 0.3169

R^2 with n_estimators=100, max_depth=5, learning_rate=0.01, min_child_weight=2: 0.3173

R^2 with n_estimators=100, max_depth=5, learning_rate=0.01, min_child_weight=4: 0.3170

R^2 with n_estimators=100, max_depth=5, learning_rate=0.05, min_child_weight=1: 0.5447

R^2 with n_estimators=100, max_depth=5, learning_rate=0.05, min_child_weight=2: 0.5480

R^2 with n_estimators=100, max_depth=5, learning_rate=0.05, min_child_weight=4: 0.5492

R^2 with n_estimators=100, max_depth=5, learning_rate=0.1, min_child_weight=1: 0.6222

R^2 with n_estimators=100, max_depth=5, learning_rate=0.1, min_child_weight=2: 0.6232

R^2 with n_estimators=100, max_depth=5, learning_rate=0.1, min_child_weight=4: 0.6216
R^2 with n_estimators=100, max_depth=7, learning_rate=0.01, min_child_weight=1: 0.4265
R^2 with n_estimators=100, max_depth=7, learning_rate=0.01, min_child_weight=2: 0.4276
R^2 with n_estimators=100, max_depth=7, learning_rate=0.01, min_child_weight=4: 0.4262
R^2 with n_estimators=100, max_depth=7, learning_rate=0.05, min_child_weight=1: 0.6672
R^2 with n_estimators=100, max_depth=7, learning_rate=0.05, min_child_weight=2: 0.6650
R^2 with n_estimators=100, max_depth=7, learning_rate=0.05, min_child_weight=4: 0.6624
R^2 with n_estimators=100, max_depth=7, learning_rate=0.1, min_child_weight=1: 0.7171
R^2 with n_estimators=100, max_depth=7, learning_rate=0.1, min_child_weight=2: 0.7204
R^2 with n_estimators=100, max_depth=7, learning_rate=0.1, min_child_weight=4: 0.7169
R^2 with n_estimators=100, max_depth=10, learning_rate=0.01, min_child_weight=1: 0.5435
R^2 with n_estimators=100, max_depth=10, learning_rate=0.01, min_child_weight=2: 0.5415
R^2 with n_estimators=100, max_depth=10, learning_rate=0.01, min_child_weight=4: 0.5401
R^2 with n_estimators=100, max_depth=10, learning_rate=0.05, min_child_weight=1: 0.7533
R^2 with n_estimators=100, max_depth=10, learning_rate=0.05, min_child_weight=2: 0.7526
R^2 with n_estimators=100, max_depth=10, learning_rate=0.05, min_child_weight=4: 0.7483
R^2 with n_estimators=100, max_depth=10, learning_rate=0.1, min_child_weight=1: 0.7670
R^2 with n_estimators=100, max_depth=10, learning_rate=0.1, min_child_weight=2: 0.7665
R^2 with n_estimators=100, max_depth=10, learning_rate=0.1, min_child_weight=4: 0.7695
R^2 with n_estimators=100, max_depth=15, learning_rate=0.01, min_child_weight=1: 0.6153
R^2 with n_estimators=100, max_depth=15, learning_rate=0.01, min_child_weight=2: 0.6129
R^2 with n_estimators=100, max_depth=15, learning_rate=0.01, min_child_weight=4: 0.6097
R^2 with n_estimators=100, max_depth=15, learning_rate=0.05, min_child_weight=1: 0.7621
R^2 with n_estimators=100, max_depth=15, learning_rate=0.05, min_child_weight=2: 0.7635
R^2 with n_estimators=100, max_depth=15, learning_rate=0.05, min_child_weight=4: 0.7619
R^2 with n_estimators=100, max_depth=15, learning_rate=0.1, min_child_weight=1: 0.7557
R^2 with n_estimators=100, max_depth=15, learning_rate=0.1, min_child_weight=2: 0.7612
R^2 with n_estimators=100, max_depth=15, learning_rate=0.1, min_child_weight=4: 0.7592
R^2 with n_estimators=110, max_depth=3, learning_rate=0.01, min_child_weight=1: 0.2230
R^2 with n_estimators=110, max_depth=3, learning_rate=0.01, min_child_weight=2: 0.2230
R^2 with n_estimators=110, max_depth=3, learning_rate=0.01, min_child_weight=4: 0.2230
R^2 with n_estimators=110, max_depth=3, learning_rate=0.05, min_child_weight=1: 0.3998

R^2 with n_estimators=110, max_depth=3, learning_rate=0.05, min_child_weight=2: 0.3998

R^2 with n_estimators=110, max_depth=3, learning_rate=0.05, min_child_weight=4: 0.3996

R^2 with n_estimators=110, max_depth=3, learning_rate=0.1, min_child_weight=1: 0.4782

R^2 with n_estimators=110, max_depth=3, learning_rate=0.1, min_child_weight=2: 0.4783

R^2 with n_estimators=110, max_depth=3, learning_rate=0.1, min_child_weight=4: 0.4781

R^2 with n_estimators=110, max_depth=5, learning_rate=0.01, min_child_weight=1: 0.3335

R^2 with n_estimators=110, max_depth=5, learning_rate=0.01, min_child_weight=2: 0.3335

R^2 with n_estimators=110, max_depth=5, learning_rate=0.01, min_child_weight=4: 0.3337

R^2 with n_estimators=110, max_depth=5, learning_rate=0.05, min_child_weight=1: 0.5553

R^2 with n_estimators=110, max_depth=5, learning_rate=0.05, min_child_weight=2: 0.5573

R^2 with n_estimators=110, max_depth=5, learning_rate=0.05, min_child_weight=4: 0.5605

R^2 with n_estimators=110, max_depth=5, learning_rate=0.1, min_child_weight=1: 0.6323

R^2 with n_estimators=110, max_depth=5, learning_rate=0.1, min_child_weight=2: 0.6334

R^2 with n_estimators=110, max_depth=5, learning_rate=0.1, min_child_weight=4: 0.6302

R^2 with n_estimators=110, max_depth=7, learning_rate=0.01, min_child_weight=1: 0.4465

R^2 with n_estimators=110, max_depth=7, learning_rate=0.01, min_child_weight=2: 0.4478

R^2 with n_estimators=110, max_depth=7, learning_rate=0.01, min_child_weight=4: 0.4468

R^2 with n_estimators=110, max_depth=7, learning_rate=0.05, min_child_weight=1: 0.6740

R^2 with n_estimators=110, max_depth=7, learning_rate=0.05, min_child_weight=2: 0.6751

R^2 with n_estimators=110, max_depth=7, learning_rate=0.05, min_child_weight=4: 0.6726

R^2 with n_estimators=110, max_depth=7, learning_rate=0.1, min_child_weight=1: 0.7237

R^2 with n_estimators=110, max_depth=7, learning_rate=0.1, min_child_weight=2: 0.7259

R^2 with n_estimators=110, max_depth=7, learning_rate=0.1, min_child_weight=4: 0.7220

R^2 with n_estimators=110, max_depth=10, learning_rate=0.01, min_child_weight=1: 0.5664

R^2 with n_estimators=110, max_depth=10, learning_rate=0.01, min_child_weight=2: 0.5644

R^2 with n_estimators=110, max_depth=10, learning_rate=0.01, min_child_weight=4: 0.5629

R^2 with n_estimators=110, max_depth=10, learning_rate=0.05, min_child_weight=1: 0.7579

R^2 with n_estimators=110, max_depth=10, learning_rate=0.05, min_child_weight=2: 0.7553

R^2 with n_estimators=110, max_depth=10, learning_rate=0.05, min_child_weight=4: 0.7525

R^2 with n_estimators=110, max_depth=10, learning_rate=0.1, min_child_weight=1: 0.7684

R^2 with n_estimators=110, max_depth=10, learning_rate=0.1, min_child_weight=2: 0.7679

R^2 with n_estimators=110, max_depth=10, learning_rate=0.1, min_child_weight=4: 0.7715

R^2 with n_estimators=110, max_depth=15, learning_rate=0.01, min_child_weight=1: 0.6361

R^2 with n_estimators=110, max_depth=15, learning_rate=0.01, min_child_weight=2: 0.6337

R^2 with n_estimators=110, max_depth=15, learning_rate=0.01, min_child_weight=4: 0.6309

R^2 with n_estimators=110, max_depth=15, learning_rate=0.05, min_child_weight=1: 0.7623

R^2 with n_estimators=110, max_depth=15, learning_rate=0.05, min_child_weight=2: 0.7640

R^2 with n_estimators=110, max_depth=15, learning_rate=0.05, min_child_weight=4: 0.7623

R^2 with n_estimators=110, max_depth=15, learning_rate=0.1, min_child_weight=1: 0.7554

R^2 with n_estimators=110, max_depth=15, learning_rate=0.1, min_child_weight=2: 0.7610

R^2 with n_estimators=110, max_depth=15, learning_rate=0.1, min_child_weight=4: 0.7590

R^2 with n_estimators=150, max_depth=3, learning_rate=0.01, min_child_weight=1: 0.2591

R^2 with n_estimators=150, max_depth=3, learning_rate=0.01, min_child_weight=2: 0.2591

R^2 with n_estimators=150, max_depth=3, learning_rate=0.01, min_child_weight=4: 0.2591

R^2 with n_estimators=150, max_depth=3, learning_rate=0.05, min_child_weight=1: 0.4329

R^2 with n_estimators=150, max_depth=3, learning_rate=0.05, min_child_weight=2: 0.4329

R^2 with n_estimators=150, max_depth=3, learning_rate=0.05, min_child_weight=4: 0.4317

R^2 with n_estimators=150, max_depth=3, learning_rate=0.1, min_child_weight=1: 0.5158

R^2 with n_estimators=150, max_depth=3, learning_rate=0.1, min_child_weight=2: 0.5180

R^2 with n_estimators=150, max_depth=3, learning_rate=0.1, min_child_weight=4: 0.5120

R^2 with n_estimators=150, max_depth=5, learning_rate=0.01, min_child_weight=1: 0.3850

R^2 with n_estimators=150, max_depth=5, learning_rate=0.01, min_child_weight=2: 0.3855

R^2 with n_estimators=150, max_depth=5, learning_rate=0.01, min_child_weight=4: 0.3844

R^2 with n_estimators=150, max_depth=5, learning_rate=0.05, min_child_weight=1: 0.5884

R^2 with n_estimators=150, max_depth=5, learning_rate=0.05, min_child_weight=2: 0.5910

R^2 with n_estimators=150, max_depth=5, learning_rate=0.05, min_child_weight=4: 0.5906

R^2 with n_estimators=150, max_depth=5, learning_rate=0.1, min_child_weight=1: 0.6589

R^2 with n_estimators=150, max_depth=5, learning_rate=0.1, min_child_weight=2: 0.6619

R^2 with n_estimators=150, max_depth=5, learning_rate=0.1, min_child_weight=4: 0.6581

R^2 with n_estimators=150, max_depth=7, learning_rate=0.01, min_child_weight=1: 0.5015

R^2 with n_estimators=150, max_depth=7, learning_rate=0.01, min_child_weight=2: 0.5024

R^2 with n_estimators=150, max_depth=7, learning_rate=0.01, min_child_weight=4: 0.5003

R^2 with n_estimators=150, max_depth=7, learning_rate=0.05, min_child_weight=1: 0.6974

R^2 with n_estimators=150, max_depth=7, learning_rate=0.05, min_child_weight=2: 0.7009

R^2 with n_estimators=150, max_depth=7, learning_rate=0.05, min_child_weight=4: 0.6973

R^2 with n_estimators=150, max_depth=7, learning_rate=0.1, min_child_weight=1: 0.7399

R^2 with n_estimators=150, max_depth=7, learning_rate=0.1, min_child_weight=2: 0.7433

R^2 with n_estimators=150, max_depth=7, learning_rate=0.1, min_child_weight=4: 0.7398

R^2 with n_estimators=150, max_depth=10, learning_rate=0.01, min_child_weight=1: 0.6282

R^2 with n_estimators=150, max_depth=10, learning_rate=0.01, min_child_weight=2: 0.6265

R^2 with n_estimators=150, max_depth=10, learning_rate=0.01, min_child_weight=4: 0.6268

R^2 with n_estimators=150, max_depth=10, learning_rate=0.05, min_child_weight=1: 0.7661

R^2 with n_estimators=150, max_depth=10, learning_rate=0.05, min_child_weight=2: 0.7654

R^2 with n_estimators=150, max_depth=10, learning_rate=0.05, min_child_weight=4: 0.7627

R^2 with n_estimators=150, max_depth=10, learning_rate=0.1, min_child_weight=1: 0.7716

R^2 with n_estimators=150, max_depth=10, learning_rate=0.1, min_child_weight=2: 0.7713

R^2 with n_estimators=150, max_depth=10, learning_rate=0.1, min_child_weight=4: 0.7754

R^2 with n_estimators=150, max_depth=15, learning_rate=0.01, min_child_weight=1: 0.6930

R^2 with n_estimators=150, max_depth=15, learning_rate=0.01, min_child_weight=2: 0.6910

R^2 with n_estimators=150, max_depth=15, learning_rate=0.01, min_child_weight=4: 0.6890

R^2 with n_estimators=150, max_depth=15, learning_rate=0.05, min_child_weight=1: 0.7621

R^2 with n_estimators=150, max_depth=15, learning_rate=0.05, min_child_weight=2: 0.7637

R^2 with n_estimators=150, max_depth=15, learning_rate=0.05, min_child_weight=4: 0.7628

R^2 with n_estimators=150, max_depth=15, learning_rate=0.1, min_child_weight=1: 0.7545

R^2 with n_estimators=150, max_depth=15, learning_rate=0.1, min_child_weight=2: 0.7598

R^2 with n_estimators=150, max_depth=15, learning_rate=0.1, min_child_weight=4: 0.7586

R^2 with n_estimators=300, max_depth=3, learning_rate=0.01, min_child_weight=1: 0.3370

R^2 with n_estimators=300, max_depth=3, learning_rate=0.01, min_child_weight=2: 0.3370

R^2 with n_estimators=300, max_depth=3, learning_rate=0.01, min_child_weight=4: 0.3370

R^2 with n_estimators=300, max_depth=3, learning_rate=0.05, min_child_weight=1: 0.5142

R^2 with n_estimators=300, max_depth=3, learning_rate=0.05, min_child_weight=2: 0.5124

R^2 with n_estimators=300, max_depth=3, learning_rate=0.05, min_child_weight=4: 0.5122

R^2 with n_estimators=300, max_depth=3, learning_rate=0.1, min_child_weight=1: 0.5875

R^2 with n_estimators=300, max_depth=3, learning_rate=0.1, min_child_weight=2: 0.5933

R^2 with n_estimators=300, max_depth=3, learning_rate=0.1, min_child_weight=4: 0.5931

R^2 with n_estimators=300, max_depth=5, learning_rate=0.01, min_child_weight=1: 0.4951

R^2 with n_estimators=300, max_depth=5, learning_rate=0.01, min_child_weight=2: 0.4948

R^2 with n_estimators=300, max_depth=5, learning_rate=0.01, min_child_weight=4: 0.4942

R^2 with n_estimators=300, max_depth=5, learning_rate=0.05, min_child_weight=1: 0.6593

R^2 with n_estimators=300, max_depth=5, learning_rate=0.05, min_child_weight=2: 0.6586

R^2 with n_estimators=300, max_depth=5, learning_rate=0.05, min_child_weight=4: 0.6558

R^2 with n_estimators=300, max_depth=5, learning_rate=0.1, min_child_weight=1: 0.7159

R^2 with n_estimators=300, max_depth=5, learning_rate=0.1, min_child_weight=2: 0.7173

R^2 with n_estimators=300, max_depth=5, learning_rate=0.1, min_child_weight=4: 0.7176

R^2 with n_estimators=300, max_depth=7, learning_rate=0.01, min_child_weight=1: 0.6134

R^2 with n_estimators=300, max_depth=7, learning_rate=0.01, min_child_weight=2: 0.6146

R^2 with n_estimators=300, max_depth=7, learning_rate=0.01, min_child_weight=4: 0.6135

R^2 with n_estimators=300, max_depth=7, learning_rate=0.05, min_child_weight=1: 0.7399

R^2 with n_estimators=300, max_depth=7, learning_rate=0.05, min_child_weight=2: 0.7426

R^2 with n_estimators=300, max_depth=7, learning_rate=0.05, min_child_weight=4: 0.7450

R^2 with n_estimators=300, max_depth=7, learning_rate=0.1, min_child_weight=1: 0.7671

R^2 with n_estimators=300, max_depth=7, learning_rate=0.1, min_child_weight=2: 0.7678

R^2 with n_estimators=300, max_depth=7, learning_rate=0.1, min_child_weight=4: 0.7680

R^2 with n_estimators=300, max_depth=10, learning_rate=0.01, min_child_weight=1: 0.7174

R^2 with n_estimators=300, max_depth=10, learning_rate=0.01, min_child_weight=2: 0.7183

R^2 with n_estimators=300, max_depth=10, learning_rate=0.01, min_child_weight=4: 0.7171

R^2 with n_estimators=300, max_depth=10, learning_rate=0.05, min_child_weight=1: 0.7776

R^2 with n_estimators=300, max_depth=10, learning_rate=0.05, min_child_weight=2: 0.7780

R^2 with n_estimators=300, max_depth=10, learning_rate=0.05, min_child_weight=4: 0.7759

R^2 with n_estimators=300, max_depth=10, learning_rate=0.1, min_child_weight=1: 0.7722

R^2 with n_estimators=300, max_depth=10, learning_rate=0.1, min_child_weight=2: 0.7719

R^2 with n_estimators=300, max_depth=10, learning_rate=0.1, min_child_weight=4: 0.7773

R^2 with n_estimators=300, max_depth=15, learning_rate=0.01, min_child_weight=1: 0.7556

R^2 with n_estimators=300, max_depth=15, learning_rate=0.01, min_child_weight=2: 0.7525

R^2 with n_estimators=300, max_depth=15, learning_rate=0.01, min_child_weight=4: 0.7529

R^2 with n_estimators=300, max_depth=15, learning_rate=0.05, min_child_weight=1: 0.7603

R^2 with n_estimators=300, max_depth=15, learning_rate=0.05, min_child_weight=2: 0.7615

R^2 with n_estimators=300, max_depth=15, learning_rate=0.05, min_child_weight=4: 0.7617

R^2 with n_estimators=300, max_depth=15, learning_rate=0.1, min_child_weight=1: 0.7538

R^2 with n_estimators=300, max_depth=15, learning_rate=0.1, min_child_weight=2: 0.7590

R^2 with n_estimators=300, max_depth=15, learning_rate=0.1, min_child_weight=4: 0.7561

R^2 with n_estimators=500, max_depth=3, learning_rate=0.01, min_child_weight=1: 0.3895

R^2 with n_estimators=500, max_depth=3, learning_rate=0.01, min_child_weight=2: 0.3895

R^2 with n_estimators=500, max_depth=3, learning_rate=0.01, min_child_weight=4: 0.3892

R^2 with n_estimators=500, max_depth=3, learning_rate=0.05, min_child_weight=1: 0.5735

R^2 with n_estimators=500, max_depth=3, learning_rate=0.05, min_child_weight=2: 0.5684

R^2 with n_estimators=500, max_depth=3, learning_rate=0.05, min_child_weight=4: 0.5709

R^2 with n_estimators=500, max_depth=3, learning_rate=0.1, min_child_weight=1: 0.6362

R^2 with n_estimators=500, max_depth=3, learning_rate=0.1, min_child_weight=2: 0.6445

R^2 with n_estimators=500, max_depth=3, learning_rate=0.1, min_child_weight=4: 0.6442

R^2 with n_estimators=500, max_depth=5, learning_rate=0.01, min_child_weight=1: 0.5490

R^2 with n_estimators=500, max_depth=5, learning_rate=0.01, min_child_weight=2: 0.5487

R^2 with n_estimators=500, max_depth=5, learning_rate=0.01, min_child_weight=4: 0.5479

R^2 with n_estimators=500, max_depth=5, learning_rate=0.05, min_child_weight=1: 0.7021

R^2 with n_estimators=500, max_depth=5, learning_rate=0.05, min_child_weight=2: 0.6986

R^2 with n_estimators=500, max_depth=5, learning_rate=0.05, min_child_weight=4: 0.6993

R^2 with n_estimators=500, max_depth=5, learning_rate=0.1, min_child_weight=1: 0.7468

R^2 with n_estimators=500, max_depth=5, learning_rate=0.1, min_child_weight=2: 0.7484

R^2 with n_estimators=500, max_depth=5, learning_rate=0.1, min_child_weight=4: 0.7470

R^2 with n_estimators=500, max_depth=7, learning_rate=0.01, min_child_weight=1: 0.6660

R^2 with n_estimators=500, max_depth=7, learning_rate=0.01, min_child_weight=2: 0.6641

R^2 with n_estimators=500, max_depth=7, learning_rate=0.01, min_child_weight=4: 0.6641

R^2 with n_estimators=500, max_depth=7, learning_rate=0.05, min_child_weight=1: 0.7626

R^2 with n_estimators=500, max_depth=7, learning_rate=0.05, min_child_weight=2: 0.7648

R^2 with n_estimators=500, max_depth=7, learning_rate=0.05, min_child_weight=4: 0.7661

R^2 with n_estimators=500, max_depth=7, learning_rate=0.1, min_child_weight=1: 0.7753

R^2 with n_estimators=500, max_depth=7, learning_rate=0.1, min_child_weight=2: 0.7739

R^2 with n_estimators=500, max_depth=7, learning_rate=0.1, min_child_weight=4: 0.7752

R^2 with n_estimators=500, max_depth=10, learning_rate=0.01, min_child_weight=1: 0.7505

R^2 with n_estimators=500, max_depth=10, learning_rate=0.01, min_child_weight=2: 0.7521

R^2 with n_estimators=500, max_depth=10, learning_rate=0.01, min_child_weight=4: 0.7512

R^2 with n_estimators=500, max_depth=10, learning_rate=0.05, min_child_weight=1: 0.7786

R^2 with n_estimators=500, max_depth=10, learning_rate=0.05, min_child_weight=2: 0.7800

R^2 with n_estimators=500, max_depth=10, learning_rate=0.05, min_child_weight=4: 0.7791

R^2 with n_estimators=500, max_depth=10, learning_rate=0.1, min_child_weight=1: 0.7703

R^2 with n_estimators=500, max_depth=10, learning_rate=0.1, min_child_weight=2: 0.7701

R^2 with n_estimators=500, max_depth=10, learning_rate=0.1, min_child_weight=4: 0.7754

R^2 with n_estimators=500, max_depth=15, learning_rate=0.01, min_child_weight=1: 0.7632

R^2 with n_estimators=500, max_depth=15, learning_rate=0.01, min_child_weight=2: 0.7611

R^2 with n_estimators=500, max_depth=15, learning_rate=0.01, min_child_weight=4: 0.7621

R^2 with n_estimators=500, max_depth=15, learning_rate=0.05, min_child_weight=1: 0.7595

R^2 with n_estimators=500, max_depth=15, learning_rate=0.05, min_child_weight=2: 0.7605

R^2 with n_estimators=500, max_depth=15, learning_rate=0.05, min_child_weight=4: 0.7602

R^2 with n_estimators=500, max_depth=15, learning_rate=0.1, min_child_weight=1: 0.7538

R^2 with n_estimators=500, max_depth=15, learning_rate=0.1, min_child_weight=2: 0.7590

R^2 with n_estimators=500, max_depth=15, learning_rate=0.1, min_child_weight=4: 0.7555

R^2 with n_estimators=1000, max_depth=3, learning_rate=0.01, min_child_weight=1: 0.4656

R^2 with n_estimators=1000, max_depth=3, learning_rate=0.01, min_child_weight=2: 0.4652

R^2 with n_estimators=1000, max_depth=3, learning_rate=0.01, min_child_weight=4: 0.4660

R^2 with n_estimators=1000, max_depth=3, learning_rate=0.05, min_child_weight=1: 0.6391

R^2 with n_estimators=1000, max_depth=3, learning_rate=0.05, min_child_weight=2: 0.6391

R^2 with n_estimators=1000, max_depth=3, learning_rate=0.05, min_child_weight=4: 0.6432

R^2 with n_estimators=1000, max_depth=3, learning_rate=0.1, min_child_weight=1: 0.6938

R^2 with n_estimators=1000, max_depth=3, learning_rate=0.1, min_child_weight=2: 0.6960

R^2 with n_estimators=1000, max_depth=3, learning_rate=0.1, min_child_weight=4: 0.6978

R^2 with n_estimators=1000, max_depth=5, learning_rate=0.01, min_child_weight=1: 0.6172

R^2 with n_estimators=1000, max_depth=5, learning_rate=0.01, min_child_weight=2: 0.6175

R^2 with n_estimators=1000, max_depth=5, learning_rate=0.01, min_child_weight=4: 0.6189

R^2 with n_estimators=1000, max_depth=5, learning_rate=0.05, min_child_weight=1: 0.7469

R^2 with n_estimators=1000, max_depth=5, learning_rate=0.05, min_child_weight=2: 0.7432

R^2 with n_estimators=1000, max_depth=5, learning_rate=0.05, min_child_weight=4: 0.7456

R^2 with n_estimators=1000, max_depth=5, learning_rate=0.1, min_child_weight=1: 0.7701

R² with n_estimators=1000, max_depth=5, learning_rate=0.1, min_child_weight=2: 0.7705
R² with n_estimators=1000, max_depth=5, learning_rate=0.1, min_child_weight=4: 0.7700
R² with n_estimators=1000, max_depth=7, learning_rate=0.01, min_child_weight=1: 0.7174
R² with n_estimators=1000, max_depth=7, learning_rate=0.01, min_child_weight=2: 0.7183
R² with n_estimators=1000, max_depth=7, learning_rate=0.01, min_child_weight=4: 0.7184
R² with n_estimators=1000, max_depth=7, learning_rate=0.05, min_child_weight=1: 0.7782
R² with n_estimators=1000, max_depth=7, learning_rate=0.05, min_child_weight=2: 0.7782
R² with n_estimators=1000, max_depth=7, learning_rate=0.05, min_child_weight=4: 0.7777
R² with n_estimators=1000, max_depth=7, learning_rate=0.1, min_child_weight=1: 0.7769
R² with n_estimators=1000, max_depth=7, learning_rate=0.1, min_child_weight=2: 0.7750
R² with n_estimators=1000, max_depth=7, learning_rate=0.1, min_child_weight=4: 0.7774
R² with n_estimators=1000, max_depth=10, learning_rate=0.01, min_child_weight=1: 0.7687
R² with n_estimators=1000, max_depth=10, learning_rate=0.01, min_child_weight=2: 0.7713
R² with n_estimators=1000, max_depth=10, learning_rate=0.01, min_child_weight=4: 0.7712
R² with n_estimators=1000, max_depth=10, learning_rate=0.05, min_child_weight=1: 0.7766
R² with n_estimators=1000, max_depth=10, learning_rate=0.05, min_child_weight=2: 0.7779
R² with n_estimators=1000, max_depth=10, learning_rate=0.05, min_child_weight=4: 0.7774
R² with n_estimators=1000, max_depth=10, learning_rate=0.1, min_child_weight=1: 0.7687
R² with n_estimators=1000, max_depth=10, learning_rate=0.1, min_child_weight=2: 0.7688
R² with n_estimators=1000, max_depth=10, learning_rate=0.1, min_child_weight=4: 0.7736
R² with n_estimators=1000, max_depth=15, learning_rate=0.01, min_child_weight=1: 0.7624
R² with n_estimators=1000, max_depth=15, learning_rate=0.01, min_child_weight=2: 0.7607
R² with n_estimators=1000, max_depth=15, learning_rate=0.01, min_child_weight=4: 0.7640
R² with n_estimators=1000, max_depth=15, learning_rate=0.05, min_child_weight=1: 0.7595
R² with n_estimators=1000, max_depth=15, learning_rate=0.05, min_child_weight=2: 0.7604
R² with n_estimators=1000, max_depth=15, learning_rate=0.05, min_child_weight=4: 0.7594
R² with n_estimators=1000, max_depth=15, learning_rate=0.1, min_child_weight=1: 0.7538
R² with n_estimators=1000, max_depth=15, learning_rate=0.1, min_child_weight=2: 0.7590
R² with n_estimators=1000, max_depth=15, learning_rate=0.1, min_child_weight=4: 0.7555

Best parameters found in the normalized dataset.:
{'n_estimators': 500, 'max_depth': 10, 'learning_rate': 0.05, 'min_child_weight': 2} 0.7800

1.5 LightGBM

Testing different parameter combinations for LightGBM on the normalized dataset (test set 15%)

```
param_grid_normalized = {
    'n_estimators': [10, 50, 100, 110, 150],
    'max_depth': [3, 5, 7, 10],
    'learning_rate': [0.01, 0.05, 0.1],
    'min_child_samples': [1, 5, 10]
}
```

R^2

R^2 with n_estimators=10, max_depth=3, learning_rate=0.01, min_child_samples=1: 0.0374

R^2 with n_estimators=10, max_depth=3, learning_rate=0.01, min_child_samples=5: 0.0374

R^2 with n_estimators=10, max_depth=3, learning_rate=0.01, min_child_samples=10: 0.0374

R^2 with n_estimators=10, max_depth=3, learning_rate=0.05, min_child_samples=1: 0.1404

R^2 with n_estimators=10, max_depth=3, learning_rate=0.05, min_child_samples=5: 0.1404

R^2 with n_estimators=10, max_depth=3, learning_rate=0.05, min_child_samples=10: 0.1404

R^2 with n_estimators=10, max_depth=3, learning_rate=0.1, min_child_samples=1: 0.2108

R^2 with n_estimators=10, max_depth=3, learning_rate=0.1, min_child_samples=5: 0.2108

R^2 with n_estimators=10, max_depth=3, learning_rate=0.1, min_child_samples=10: 0.2108

R^2 with n_estimators=10, max_depth=5, learning_rate=0.01, min_child_samples=1: 0.0567

R^2 with n_estimators=10, max_depth=5, learning_rate=0.01, min_child_samples=5: 0.0567

R^2 with n_estimators=10, max_depth=5, learning_rate=0.01, min_child_samples=10: 0.0567

R^2 with n_estimators=10, max_depth=5, learning_rate=0.05, min_child_samples=1: 0.2053

R^2 with n_estimators=10, max_depth=5, learning_rate=0.05, min_child_samples=5: 0.2061

R^2 with n_estimators=10, max_depth=5, learning_rate=0.05, min_child_samples=10: 0.2054

R^2 with n_estimators=10, max_depth=5, learning_rate=0.1, min_child_samples=1: 0.3134

R^2 with n_estimators=10, max_depth=5, learning_rate=0.1, min_child_samples=5: 0.3135

R^2 with n_estimators=10, max_depth=5, learning_rate=0.1, min_child_samples=10: 0.3161

R^2 with n_estimators=10, max_depth=7, learning_rate=0.01, min_child_samples=1: 0.0634

R^2 with n_estimators=10, max_depth=7, learning_rate=0.01, min_child_samples=5: 0.0634

R^2 with n_estimators=10, max_depth=7, learning_rate=0.01, min_child_samples=10: 0.0631

R^2 with n_estimators=10, max_depth=7, learning_rate=0.05, min_child_samples=1: 0.2349

R^2 with n_estimators=10, max_depth=7, learning_rate=0.05, min_child_samples=5: 0.2349

R^2 with n_estimators=10, max_depth=7, learning_rate=0.05, min_child_samples=10: 0.2342

R^2 with n_estimators=10, max_depth=7, learning_rate=0.1, min_child_samples=1: 0.3559

R^2 with n_estimators=10, max_depth=7, learning_rate=0.1, min_child_samples=5: 0.3559

R^2 with n_estimators=10, max_depth=7, learning_rate=0.1, min_child_samples=10: 0.3566

R^2 with n_estimators=10, max_depth=10, learning_rate=0.01, min_child_samples=1: 0.0629

R^2 with n_estimators=10, max_depth=10, learning_rate=0.01, min_child_samples=5: 0.0629

R^2 with n_estimators=10, max_depth=10, learning_rate=0.01, min_child_samples=10: 0.0629

R^2 with n_estimators=10, max_depth=10, learning_rate=0.05, min_child_samples=1: 0.2401

R^2 with n_estimators=10, max_depth=10, learning_rate=0.05, min_child_samples=5: 0.2401

R^2 with n_estimators=10, max_depth=10, learning_rate=0.05, min_child_samples=10: 0.2406

R^2 with n_estimators=10, max_depth=10, learning_rate=0.1, min_child_samples=1: 0.3599

R^2 with n_estimators=10, max_depth=10, learning_rate=0.1, min_child_samples=5: 0.3599

R^2 with n_estimators=10, max_depth=10, learning_rate=0.1, min_child_samples=10: 0.3619

R^2 with n_estimators=10, max_depth=15, learning_rate=0.01, min_child_samples=1: 0.0629

R^2 with n_estimators=10, max_depth=15, learning_rate=0.01, min_child_samples=5: 0.0629

R^2 with n_estimators=10, max_depth=15, learning_rate=0.01, min_child_samples=10: 0.0629

R^2 with n_estimators=10, max_depth=15, learning_rate=0.05, min_child_samples=1: 0.2407

R^2 with n_estimators=10, max_depth=15, learning_rate=0.05, min_child_samples=5: 0.2407

R^2 with n_estimators=10, max_depth=15, learning_rate=0.05, min_child_samples=10: 0.2409

R^2 with n_estimators=10, max_depth=15, learning_rate=0.1, min_child_samples=1: 0.3599

R^2 with n_estimators=10, max_depth=15, learning_rate=0.1, min_child_samples=5: 0.3599

R^2 with n_estimators=10, max_depth=15, learning_rate=0.1, min_child_samples=10: 0.3597

R^2 with n_estimators=50, max_depth=3, learning_rate=0.01, min_child_samples=1: 0.1384

R^2 with n_estimators=50, max_depth=3, learning_rate=0.01, min_child_samples=5: 0.1384

R^2 with n_estimators=50, max_depth=3, learning_rate=0.01, min_child_samples=10: 0.1384

R^2 with n_estimators=50, max_depth=3, learning_rate=0.05, min_child_samples=1: 0.3173

R^2 with n_estimators=50, max_depth=3, learning_rate=0.05, min_child_samples=5: 0.3173

R^2 with n_estimators=50, max_depth=3, learning_rate=0.05, min_child_samples=10: 0.3166

R^2 with n_estimators=50, max_depth=3, learning_rate=0.1, min_child_samples=1: 0.3819

R^2 with n_estimators=50, max_depth=3, learning_rate=0.1, min_child_samples=5: 0.3863

R^2 with n_estimators=50, max_depth=3, learning_rate=0.1, min_child_samples=10: 0.3834

R^2 with n_estimators=50, max_depth=5, learning_rate=0.01, min_child_samples=1: 0.2048

R^2 with n_estimators=50, max_depth=5, learning_rate=0.01, min_child_samples=5: 0.2047

R^2 with n_estimators=50, max_depth=5, learning_rate=0.01, min_child_samples=10: 0.2040

R^2 with n_estimators=50, max_depth=5, learning_rate=0.05, min_child_samples=1: 0.4687

R^2 with n_estimators=50, max_depth=5, learning_rate=0.05, min_child_samples=5: 0.4669

R^2 with n_estimators=50, max_depth=5, learning_rate=0.05, min_child_samples=10: 0.4670

R^2 with n_estimators=50, max_depth=5, learning_rate=0.1, min_child_samples=1: 0.5416

R^2 with n_estimators=50, max_depth=5, learning_rate=0.1, min_child_samples=5: 0.5516

R^2 with n_estimators=50, max_depth=5, learning_rate=0.1, min_child_samples=10: 0.5474

R^2 with n_estimators=50, max_depth=7, learning_rate=0.01, min_child_samples=1: 0.2331

R^2 with n_estimators=50, max_depth=7, learning_rate=0.01, min_child_samples=5: 0.2332

R^2 with n_estimators=50, max_depth=7, learning_rate=0.01, min_child_samples=10: 0.2328

R^2 with n_estimators=50, max_depth=7, learning_rate=0.05, min_child_samples=1: 0.5050

R^2 with n_estimators=50, max_depth=7, learning_rate=0.05, min_child_samples=5: 0.5030

R^2 with n_estimators=50, max_depth=7, learning_rate=0.05, min_child_samples=10: 0.5049

R^2 with n_estimators=50, max_depth=7, learning_rate=0.1, min_child_samples=1: 0.5879

R^2 with n_estimators=50, max_depth=7, learning_rate=0.1, min_child_samples=5: 0.5886

R^2 with n_estimators=50, max_depth=7, learning_rate=0.1, min_child_samples=10: 0.5896

R^2 with n_estimators=50, max_depth=10, learning_rate=0.01, min_child_samples=1: 0.2373

R^2 with n_estimators=50, max_depth=10, learning_rate=0.01, min_child_samples=5: 0.2373

R^2 with n_estimators=50, max_depth=10, learning_rate=0.01, min_child_samples=10: 0.2379

R^2 with n_estimators=50, max_depth=10, learning_rate=0.05, min_child_samples=1: 0.5066

R^2 with n_estimators=50, max_depth=10, learning_rate=0.05, min_child_samples=5: 0.5049

R^2 with n_estimators=50, max_depth=10, learning_rate=0.05, min_child_samples=10: 0.5084

R^2 with n_estimators=50, max_depth=10, learning_rate=0.1, min_child_samples=1: 0.5939

R^2 with n_estimators=50, max_depth=10, learning_rate=0.1, min_child_samples=5: 0.5992

R^2 with n_estimators=50, max_depth=10, learning_rate=0.1, min_child_samples=10: 0.5998

R^2 with n_estimators=50, max_depth=15, learning_rate=0.01, min_child_samples=1: 0.2370

R^2 with n_estimators=50, max_depth=15, learning_rate=0.01, min_child_samples=5: 0.2370

R^2 with n_estimators=50, max_depth=15, learning_rate=0.01, min_child_samples=10: 0.2376

R^2 with n_estimators=50, max_depth=15, learning_rate=0.05, min_child_samples=1: 0.5089

R^2 with n_estimators=50, max_depth=15, learning_rate=0.05, min_child_samples=5: 0.5068

R^2 with n_estimators=50, max_depth=15, learning_rate=0.05, min_child_samples=10: 0.5094

R^2 with n_estimators=50, max_depth=15, learning_rate=0.1, min_child_samples=1: 0.5966

R^2 with n_estimators=50, max_depth=15, learning_rate=0.1, min_child_samples=5: 0.5989

R^2 with n_estimators=50, max_depth=15, learning_rate=0.1, min_child_samples=10: 0.6001

R^2 with n_estimators=100, max_depth=3, learning_rate=0.01, min_child_samples=1: 0.2086

R^2 with n_estimators=100, max_depth=3, learning_rate=0.01, min_child_samples=5: 0.2086

R^2 with n_estimators=100, max_depth=3, learning_rate=0.01, min_child_samples=10: 0.2086

R^2 with n_estimators=100, max_depth=3, learning_rate=0.05, min_child_samples=1: 0.3892

R^2 with n_estimators=100, max_depth=3, learning_rate=0.05, min_child_samples=5: 0.3894

R^2 with n_estimators=100, max_depth=3, learning_rate=0.05, min_child_samples=10: 0.3892

R^2 with n_estimators=100, max_depth=3, learning_rate=0.1, min_child_samples=1: 0.4659

R^2 with n_estimators=100, max_depth=3, learning_rate=0.1, min_child_samples=5: 0.4642

R^2 with n_estimators=100, max_depth=3, learning_rate=0.1, min_child_samples=10: 0.4659

R^2 with n_estimators=100, max_depth=5, learning_rate=0.01, min_child_samples=1: 0.3118

R^2 with n_estimators=100, max_depth=5, learning_rate=0.01, min_child_samples=5: 0.3123

R^2 with n_estimators=100, max_depth=5, learning_rate=0.01, min_child_samples=10: 0.3105

R^2 with n_estimators=100, max_depth=5, learning_rate=0.05, min_child_samples=1: 0.5473

R^2 with n_estimators=100, max_depth=5, learning_rate=0.05, min_child_samples=5: 0.5473

R^2 with n_estimators=100, max_depth=5, learning_rate=0.05, min_child_samples=10: 0.5492

R^2 with n_estimators=100, max_depth=5, learning_rate=0.1, min_child_samples=1: 0.6167

R^2 with n_estimators=100, max_depth=5, learning_rate=0.1, min_child_samples=5: 0.6209

R^2 with n_estimators=100, max_depth=5, learning_rate=0.1, min_child_samples=10: 0.6215

R^2 with n_estimators=100, max_depth=7, learning_rate=0.01, min_child_samples=1: 0.3516

R^2 with n_estimators=100, max_depth=7, learning_rate=0.01, min_child_samples=5: 0.3516

R^2 with n_estimators=100, max_depth=7, learning_rate=0.01, min_child_samples=10: 0.3509

R^2 with n_estimators=100, max_depth=7, learning_rate=0.05, min_child_samples=1: 0.5894

R^2 with n_estimators=100, max_depth=7, learning_rate=0.05, min_child_samples=5: 0.5931

R^2 with n_estimators=100, max_depth=7, learning_rate=0.05, min_child_samples=10: 0.5933

R^2 with n_estimators=100, max_depth=7, learning_rate=0.1, min_child_samples=1: 0.6585

R^2 with n_estimators=100, max_depth=7, learning_rate=0.1, min_child_samples=5: 0.6580

R^2 with n_estimators=100, max_depth=7, learning_rate=0.1, min_child_samples=10: 0.6602

R^2 with n_estimators=100, max_depth=10, learning_rate=0.01, min_child_samples=1: 0.3550

R^2 with n_estimators=100, max_depth=10, learning_rate=0.01, min_child_samples=5: 0.3550

R^2 with n_estimators=100, max_depth=10, learning_rate=0.01, min_child_samples=10: 0.3553

R^2 with n_estimators=100, max_depth=10, learning_rate=0.05, min_child_samples=1: 0.5964

R^2 with n_estimators=100, max_depth=10, learning_rate=0.05, min_child_samples=5: 0.5953

R^2 with n_estimators=100, max_depth=10, learning_rate=0.05, min_child_samples=10: 0.5998

R^2 with n_estimators=100, max_depth=10, learning_rate=0.1, min_child_samples=1: 0.6628

R^2 with n_estimators=100, max_depth=10, learning_rate=0.1, min_child_samples=5: 0.6656

R^2 with n_estimators=100, max_depth=10, learning_rate=0.1, min_child_samples=10: 0.6624

R^2 with n_estimators=100, max_depth=15, learning_rate=0.01, min_child_samples=1: 0.3543

R^2 with n_estimators=100, max_depth=15, learning_rate=0.01, min_child_samples=5: 0.3547

R^2 with n_estimators=100, max_depth=15, learning_rate=0.01, min_child_samples=10: 0.3558

R^2 with n_estimators=100, max_depth=15, learning_rate=0.05, min_child_samples=1: 0.6011

R^2 with n_estimators=100, max_depth=15, learning_rate=0.05, min_child_samples=5: 0.6003

R^2 with n_estimators=100, max_depth=15, learning_rate=0.05, min_child_samples=10: 0.6016

R^2 with n_estimators=100, max_depth=15, learning_rate=0.1, min_child_samples=1: 0.6603

R^2 with n_estimators=100, max_depth=15, learning_rate=0.1, min_child_samples=5: 0.6661

R^2 with n_estimators=100, max_depth=15, learning_rate=0.1, min_child_samples=10: 0.6666

R^2 with n_estimators=110, max_depth=3, learning_rate=0.01, min_child_samples=1: 0.2192

R^2 with n_estimators=110, max_depth=3, learning_rate=0.01, min_child_samples=5: 0.2192

R^2 with n_estimators=110, max_depth=3, learning_rate=0.01, min_child_samples=10: 0.2192

R^2 with n_estimators=110, max_depth=3, learning_rate=0.05, min_child_samples=1: 0.3994

R^2 with n_estimators=110, max_depth=3, learning_rate=0.05, min_child_samples=5: 0.4001

R^2 with n_estimators=110, max_depth=3, learning_rate=0.05, min_child_samples=10: 0.3998

R^2 with n_estimators=110, max_depth=3, learning_rate=0.1, min_child_samples=1: 0.4776

R^2 with n_estimators=110, max_depth=3, learning_rate=0.1, min_child_samples=5: 0.4750

R^2 with n_estimators=110, max_depth=3, learning_rate=0.1, min_child_samples=10: 0.4734

R^2 with n_estimators=110, max_depth=5, learning_rate=0.01, min_child_samples=1: 0.3269

R^2 with n_estimators=110, max_depth=5, learning_rate=0.01, min_child_samples=5: 0.3278

R^2 with n_estimators=110, max_depth=5, learning_rate=0.01, min_child_samples=10: 0.3261

R^2 with n_estimators=110, max_depth=5, learning_rate=0.05, min_child_samples=1: 0.5598

R^2 with n_estimators=110, max_depth=5, learning_rate=0.05, min_child_samples=5: 0.5571

R^2 with n_estimators=110, max_depth=5, learning_rate=0.05, min_child_samples=10: 0.5626

R^2 with n_estimators=110, max_depth=5, learning_rate=0.1, min_child_samples=1: 0.6261

R^2 with n_estimators=110, max_depth=5, learning_rate=0.1, min_child_samples=5: 0.6314

R^2 with n_estimators=110, max_depth=5, learning_rate=0.1, min_child_samples=10: 0.6294

R^2 with n_estimators=110, max_depth=7, learning_rate=0.01, min_child_samples=1: 0.3676

R^2 with n_estimators=110, max_depth=7, learning_rate=0.01, min_child_samples=5: 0.3680

R^2 with n_estimators=110, max_depth=7, learning_rate=0.01, min_child_samples=10: 0.3671

R^2 with n_estimators=110, max_depth=7, learning_rate=0.05, min_child_samples=1: 0.6013

R^2 with n_estimators=110, max_depth=7, learning_rate=0.05, min_child_samples=5: 0.6032

R^2 with n_estimators=110, max_depth=7, learning_rate=0.05, min_child_samples=10: 0.6044

R^2 with n_estimators=110, max_depth=7, learning_rate=0.1, min_child_samples=1: 0.6655

R^2 with n_estimators=110, max_depth=7, learning_rate=0.1, min_child_samples=5: 0.6643

R^2 with n_estimators=110, max_depth=7, learning_rate=0.1, min_child_samples=10: 0.6674

R^2 with n_estimators=110, max_depth=10, learning_rate=0.01, min_child_samples=1: 0.3713

R^2 with n_estimators=110, max_depth=10, learning_rate=0.01, min_child_samples=5: 0.3713

R^2 with n_estimators=110, max_depth=10, learning_rate=0.01, min_child_samples=10: 0.3711

R^2 with n_estimators=110, max_depth=10, learning_rate=0.05, min_child_samples=1: 0.6059

R^2 with n_estimators=110, max_depth=10, learning_rate=0.05, min_child_samples=5: 0.6064

R^2 with n_estimators=110, max_depth=10, learning_rate=0.05, min_child_samples=10: 0.6098

R^2 with n_estimators=110, max_depth=10, learning_rate=0.1, min_child_samples=1: 0.6713

R^2 with n_estimators=110, max_depth=10, learning_rate=0.1, min_child_samples=5: 0.6739

R^2 with n_estimators=110, max_depth=10, learning_rate=0.1, min_child_samples=10: 0.6703

R^2 with n_estimators=110, max_depth=15, learning_rate=0.01, min_child_samples=1: 0.3702

R^2 with n_estimators=110, max_depth=15, learning_rate=0.01, min_child_samples=5: 0.3703

R^2 with n_estimators=110, max_depth=15, learning_rate=0.01, min_child_samples=10: 0.3716

R^2 with n_estimators=110, max_depth=15, learning_rate=0.05, min_child_samples=1: 0.6114

R^2 with n_estimators=110, max_depth=15, learning_rate=0.05, min_child_samples=5: 0.6095

R^2 with n_estimators=110, max_depth=15, learning_rate=0.05, min_child_samples=10: 0.6125

R^2 with n_estimators=110, max_depth=15, learning_rate=0.1, min_child_samples=1: 0.6682

R^2 with n_estimators=110, max_depth=15, learning_rate=0.1, min_child_samples=5: 0.6737

R^2 with n_estimators=110, max_depth=15, learning_rate=0.1, min_child_samples=10: 0.6751

R^2 with n_estimators=150, max_depth=3, learning_rate=0.01, min_child_samples=1: 0.2570

R^2 with n_estimators=150, max_depth=3, learning_rate=0.01, min_child_samples=5: 0.2570

R^2 with n_estimators=150, max_depth=3, learning_rate=0.01, min_child_samples=10: 0.2567

R^2 with n_estimators=150, max_depth=3, learning_rate=0.05, min_child_samples=1: 0.4339

R^2 with n_estimators=150, max_depth=3, learning_rate=0.05, min_child_samples=5: 0.4364

R^2 with n_estimators=150, max_depth=3, learning_rate=0.05, min_child_samples=10: 0.4360

R^2 with n_estimators=150, max_depth=3, learning_rate=0.1, min_child_samples=1: 0.5150

R^2 with n_estimators=150, max_depth=3, learning_rate=0.1, min_child_samples=5: 0.5148

R^2 with n_estimators=150, max_depth=3, learning_rate=0.1, min_child_samples=10: 0.5116

R^2 with n_estimators=150, max_depth=5, learning_rate=0.01, min_child_samples=1: 0.3813

R^2 with n_estimators=150, max_depth=5, learning_rate=0.01, min_child_samples=5: 0.3818

R^2 with n_estimators=150, max_depth=5, learning_rate=0.01, min_child_samples=10: 0.3800

R^2 with n_estimators=150, max_depth=5, learning_rate=0.05, min_child_samples=1: 0.5908

R^2 with n_estimators=150, max_depth=5, learning_rate=0.05, min_child_samples=5: 0.5860

R^2 with n_estimators=150, max_depth=5, learning_rate=0.05, min_child_samples=10: 0.5925

R^2 with n_estimators=150, max_depth=5, learning_rate=0.1, min_child_samples=1: 0.6587

R^2 with n_estimators=150, max_depth=5, learning_rate=0.1, min_child_samples=5: 0.6617

R^2 with n_estimators=150, max_depth=5, learning_rate=0.1, min_child_samples=10: 0.6586

R^2 with n_estimators=150, max_depth=7, learning_rate=0.01, min_child_samples=1: 0.4196

R^2 with n_estimators=150, max_depth=7, learning_rate=0.01, min_child_samples=5: 0.4205

R^2 with n_estimators=150, max_depth=7, learning_rate=0.01, min_child_samples=10: 0.4189

R^2 with n_estimators=150, max_depth=7, learning_rate=0.05, min_child_samples=1: 0.6329

R^2 with n_estimators=150, max_depth=7, learning_rate=0.05, min_child_samples=5: 0.6343

R^2 with n_estimators=150, max_depth=7, learning_rate=0.05, min_child_samples=10: 0.6352

R^2 with n_estimators=150, max_depth=7, learning_rate=0.1, min_child_samples=1: 0.6888

R^2 with n_estimators=150, max_depth=7, learning_rate=0.1, min_child_samples=5: 0.6910

R^2 with n_estimators=150, max_depth=7, learning_rate=0.1, min_child_samples=10: 0.6922

R^2 with n_estimators=150, max_depth=10, learning_rate=0.01, min_child_samples=1: 0.4228

R^2 with n_estimators=150, max_depth=10, learning_rate=0.01, min_child_samples=5: 0.4228

R^2 with n_estimators=150, max_depth=10, learning_rate=0.01, min_child_samples=10: 0.4220

R^2 with n_estimators=150, max_depth=10, learning_rate=0.05, min_child_samples=1: 0.6387

R^2 with n_estimators=150, max_depth=10, learning_rate=0.05, min_child_samples=5: 0.6375

R^2 with n_estimators=150, max_depth=10, learning_rate=0.05, min_child_samples=10: 0.6409

R^2 with n_estimators=150, max_depth=10, learning_rate=0.1, min_child_samples=1: 0.6941

R^2 with n_estimators=150, max_depth=10, learning_rate=0.1, min_child_samples=5: 0.6999

R^2 with n_estimators=150, max_depth=10, learning_rate=0.1, min_child_samples=10: 0.6953

R^2 with n_estimators=150, max_depth=15, learning_rate=0.01, min_child_samples=1: 0.4218

R^2 with n_estimators=150, max_depth=15, learning_rate=0.01, min_child_samples=5: 0.4220

R^2 with n_estimators=150, max_depth=15, learning_rate=0.01, min_child_samples=10: 0.4227

R^2 with n_estimators=150, max_depth=15, learning_rate=0.05, min_child_samples=1: 0.6420

R^2 with n_estimators=150, max_depth=15, learning_rate=0.05, min_child_samples=5: 0.6422

R^2 with n_estimators=150, max_depth=15, learning_rate=0.05, min_child_samples=10: 0.6424

R^2 with n_estimators=150, max_depth=15, learning_rate=0.1, min_child_samples=1: 0.6907

R^2 with n_estimators=150, max_depth=15, learning_rate=0.1, min_child_samples=5: 0.6961

R^2 with n_estimators=150, max_depth=15, learning_rate=0.1, min_child_samples=10: 0.6983

R^2 with n_estimators=300, max_depth=3, learning_rate=0.01, min_child_samples=1: 0.3338

R^2 with n_estimators=300, max_depth=3, learning_rate=0.01, min_child_samples=5: 0.3338

R^2 with n_estimators=300, max_depth=3, learning_rate=0.01, min_child_samples=10: 0.3333

R^2 with n_estimators=300, max_depth=3, learning_rate=0.05, min_child_samples=1: 0.5126

R^2 with n_estimators=300, max_depth=3, learning_rate=0.05, min_child_samples=5: 0.5155

R^2 with n_estimators=300, max_depth=3, learning_rate=0.05, min_child_samples=10: 0.5126

R^2 with n_estimators=300, max_depth=3, learning_rate=0.1, min_child_samples=1: 0.5909

R^2 with n_estimators=300, max_depth=3, learning_rate=0.1, min_child_samples=5: 0.5917

R^2 with n_estimators=300, max_depth=3, learning_rate=0.1, min_child_samples=10: 0.5896

R^2 with n_estimators=300, max_depth=5, learning_rate=0.01, min_child_samples=1: 0.4888

R^2 with n_estimators=300, max_depth=5, learning_rate=0.01, min_child_samples=5: 0.4907

R^2 with n_estimators=300, max_depth=5, learning_rate=0.01, min_child_samples=10: 0.4892

R^2 with n_estimators=300, max_depth=5, learning_rate=0.05, min_child_samples=1: 0.6658

R^2 with n_estimators=300, max_depth=5, learning_rate=0.05, min_child_samples=5: 0.6592

R^2 with n_estimators=300, max_depth=5, learning_rate=0.05, min_child_samples=10: 0.6599

R^2 with n_estimators=300, max_depth=5, learning_rate=0.1, min_child_samples=1: 0.7145

R^2 with n_estimators=300, max_depth=5, learning_rate=0.1, min_child_samples=5: 0.7165

R^2 with n_estimators=300, max_depth=5, learning_rate=0.1, min_child_samples=10: 0.7136

R^2 with n_estimators=300, max_depth=7, learning_rate=0.01, min_child_samples=1: 0.5273

R^2 with n_estimators=300, max_depth=7, learning_rate=0.01, min_child_samples=5: 0.5293

R^2 with n_estimators=300, max_depth=7, learning_rate=0.01, min_child_samples=10: 0.5288

R^2 with n_estimators=300, max_depth=7, learning_rate=0.05, min_child_samples=1: 0.6871

R^2 with n_estimators=300, max_depth=7, learning_rate=0.05, min_child_samples=5: 0.6916

R^2 with n_estimators=300, max_depth=7, learning_rate=0.05, min_child_samples=10: 0.6942

R^2 with n_estimators=300, max_depth=7, learning_rate=0.1, min_child_samples=1: 0.7320

R^2 with n_estimators=300, max_depth=7, learning_rate=0.1, min_child_samples=5: 0.7327

R^2 with n_estimators=300, max_depth=7, learning_rate=0.1, min_child_samples=10: 0.7402

R^2 with n_estimators=300, max_depth=10, learning_rate=0.01, min_child_samples=1: 0.5326

R^2 with n_estimators=300, max_depth=10, learning_rate=0.01, min_child_samples=5: 0.5332

R^2 with n_estimators=300, max_depth=10, learning_rate=0.01, min_child_samples=10: 0.5317

R^2 with n_estimators=300, max_depth=10, learning_rate=0.05, min_child_samples=1: 0.6987

R^2 with n_estimators=300, max_depth=10, learning_rate=0.05, min_child_samples=5: 0.6968

R^2 with n_estimators=300, max_depth=10, learning_rate=0.05, min_child_samples=10: 0.6998

R^2 with n_estimators=300, max_depth=10, learning_rate=0.1, min_child_samples=1: 0.7354

R^2 with n_estimators=300, max_depth=10, learning_rate=0.1, min_child_samples=5: 0.7447

R^2 with n_estimators=300, max_depth=10, learning_rate=0.1, min_child_samples=10: 0.7406

R^2 with n_estimators=300, max_depth=15, learning_rate=0.01, min_child_samples=1: 0.5336

R^2 with n_estimators=300, max_depth=15, learning_rate=0.01, min_child_samples=5: 0.5328

R^2 with n_estimators=300, max_depth=15, learning_rate=0.01, min_child_samples=10: 0.5336

R^2 with n_estimators=300, max_depth=15, learning_rate=0.05, min_child_samples=1: 0.6996

R^2 with n_estimators=300, max_depth=15, learning_rate=0.05, min_child_samples=5: 0.7003

R^2 with n_estimators=300, max_depth=15, learning_rate=0.05, min_child_samples=10: 0.6987

R^2 with n_estimators=300, max_depth=15, learning_rate=0.1, min_child_samples=1: 0.7356

R^2 with n_estimators=300, max_depth=15, learning_rate=0.1, min_child_samples=5: 0.7382

R^2 with n_estimators=300, max_depth=15, learning_rate=0.1, min_child_samples=10: 0.7438

R^2 with n_estimators=500, max_depth=3, learning_rate=0.01, min_child_samples=1: 0.3876

R^2 with n_estimators=500, max_depth=3, learning_rate=0.01, min_child_samples=5: 0.3883

R^2 with n_estimators=500, max_depth=3, learning_rate=0.01, min_child_samples=10: 0.3881

R^2 with n_estimators=500, max_depth=3, learning_rate=0.05, min_child_samples=1: 0.5680

R^2 with n_estimators=500, max_depth=3, learning_rate=0.05, min_child_samples=5: 0.5678

R^2 with n_estimators=500, max_depth=3, learning_rate=0.05, min_child_samples=10: 0.5723

R^2 with n_estimators=500, max_depth=3, learning_rate=0.1, min_child_samples=1: 0.6402

R^2 with n_estimators=500, max_depth=3, learning_rate=0.1, min_child_samples=5: 0.6412

R^2 with n_estimators=500, max_depth=3, learning_rate=0.1, min_child_samples=10: 0.6415

R^2 with n_estimators=500, max_depth=5, learning_rate=0.01, min_child_samples=1: 0.5496

R^2 with n_estimators=500, max_depth=5, learning_rate=0.01, min_child_samples=5: 0.5514

R^2 with n_estimators=500, max_depth=5, learning_rate=0.01, min_child_samples=10: 0.5495

R^2 with n_estimators=500, max_depth=5, learning_rate=0.05, min_child_samples=1: 0.7052

R^2 with n_estimators=500, max_depth=5, learning_rate=0.05, min_child_samples=5: 0.7063

R^2 with n_estimators=500, max_depth=5, learning_rate=0.05, min_child_samples=10: 0.7065

R^2 with n_estimators=500, max_depth=5, learning_rate=0.1, min_child_samples=1: 0.7448

R^2 with n_estimators=500, max_depth=5, learning_rate=0.1, min_child_samples=5: 0.7441

R^2 with n_estimators=500, max_depth=5, learning_rate=0.1, min_child_samples=10: 0.7414

R^2 with n_estimators=500, max_depth=7, learning_rate=0.01, min_child_samples=1: 0.5923

R^2 with n_estimators=500, max_depth=7, learning_rate=0.01, min_child_samples=5: 0.5936

R^2 with n_estimators=500, max_depth=7, learning_rate=0.01, min_child_samples=10: 0.5933

R^2 with n_estimators=500, max_depth=7, learning_rate=0.05, min_child_samples=1: 0.7221

R^2 with n_estimators=500, max_depth=7, learning_rate=0.05, min_child_samples=5: 0.7271

R^2 with n_estimators=500, max_depth=7, learning_rate=0.05, min_child_samples=10: 0.7268

R^2 with n_estimators=500, max_depth=7, learning_rate=0.1, min_child_samples=1: 0.7562

R^2 with n_estimators=500, max_depth=7, learning_rate=0.1, min_child_samples=5: 0.7556

R^2 with n_estimators=500, max_depth=7, learning_rate=0.1, min_child_samples=10: 0.7620

R^2 with n_estimators=500, max_depth=10, learning_rate=0.01, min_child_samples=1: 0.5979

R^2 with n_estimators=500, max_depth=10, learning_rate=0.01, min_child_samples=5: 0.5996

R^2 with n_estimators=500, max_depth=10, learning_rate=0.01, min_child_samples=10: 0.5984

R^2 with n_estimators=500, max_depth=10, learning_rate=0.05, min_child_samples=1: 0.7300

R^2 with n_estimators=500, max_depth=10, learning_rate=0.05, min_child_samples=5: 0.7316

R^2 with n_estimators=500, max_depth=10, learning_rate=0.05, min_child_samples=10: 0.7336

R^2 with n_estimators=500, max_depth=10, learning_rate=0.1, min_child_samples=1: 0.7568

R^2 with n_estimators=500, max_depth=10, learning_rate=0.1, min_child_samples=5: 0.7650

R^2 with n_estimators=500, max_depth=10, learning_rate=0.1, min_child_samples=10: 0.7615

R^2 with n_estimators=500, max_depth=15, learning_rate=0.01, min_child_samples=1: 0.6000

R^2 with n_estimators=500, max_depth=15, learning_rate=0.01, min_child_samples=5: 0.6004

R^2 with n_estimators=500, max_depth=15, learning_rate=0.01, min_child_samples=10: 0.6002

R^2 with n_estimators=500, max_depth=15, learning_rate=0.05, min_child_samples=1: 0.7320

R^2 with n_estimators=500, max_depth=15, learning_rate=0.05, min_child_samples=5: 0.7313

R^2 with n_estimators=500, max_depth=15, learning_rate=0.05, min_child_samples=10: 0.7331

R^2 with n_estimators=500, max_depth=15, learning_rate=0.1, min_child_samples=1: 0.7570

R^2 with n_estimators=500, max_depth=15, learning_rate=0.1, min_child_samples=5: 0.7619

R^2 with n_estimators=500, max_depth=15, learning_rate=0.1, min_child_samples=10: 0.7648

R^2 with n_estimators=1000, max_depth=3, learning_rate=0.01, min_child_samples=1: 0.4666

R^2 with n_estimators=1000, max_depth=3, learning_rate=0.01, min_child_samples=5: 0.4689

R^2 with n_estimators=1000, max_depth=3, learning_rate=0.01, min_child_samples=10: 0.4676

R^2 with n_estimators=1000, max_depth=3, learning_rate=0.05, min_child_samples=1: 0.6344

R^2 with n_estimators=1000, max_depth=3, learning_rate=0.05, min_child_samples=5: 0.6372

R^2 with n_estimators=1000, max_depth=3, learning_rate=0.05, min_child_samples=10: 0.6404

R^2 with n_estimators=1000, max_depth=3, learning_rate=0.1, min_child_samples=1: 0.6942

R^2 with n_estimators=1000, max_depth=3, learning_rate=0.1, min_child_samples=5: 0.6947

R^2 with n_estimators=1000, max_depth=3, learning_rate=0.1, min_child_samples=10: 0.6961

R^2 with n_estimators=1000, max_depth=5, learning_rate=0.01, min_child_samples=1: 0.6200

R^2 with n_estimators=1000, max_depth=5, learning_rate=0.01, min_child_samples=5: 0.6246

R^2 with n_estimators=1000, max_depth=5, learning_rate=0.01, min_child_samples=10: 0.6238

R^2 with n_estimators=1000, max_depth=5, learning_rate=0.05, min_child_samples=1: 0.7449

R^2 with n_estimators=1000, max_depth=5, learning_rate=0.05, min_child_samples=5: 0.7497

R^2 with n_estimators=1000, max_depth=5, learning_rate=0.05, min_child_samples=10: 0.7474

R^2 with n_estimators=1000, max_depth=5, learning_rate=0.1, min_child_samples=1: 0.7690

R^2 with n_estimators=1000, max_depth=5, learning_rate=0.1, min_child_samples=5: 0.7657

R^2 with n_estimators=1000, max_depth=5, learning_rate=0.1, min_child_samples=10: 0.7678

R^2 with n_estimators=1000, max_depth=7, learning_rate=0.01, min_child_samples=1: 0.6614

R^2 with n_estimators=1000, max_depth=7, learning_rate=0.01, min_child_samples=5: 0.6615

R^2 with n_estimators=1000, max_depth=7, learning_rate=0.01, min_child_samples=10: 0.6611

R^2 with n_estimators=1000, max_depth=7, learning_rate=0.05, min_child_samples=1: 0.7545

R^2 with n_estimators=1000, max_depth=7, learning_rate=0.05, min_child_samples=5: 0.7600

R^2 with n_estimators=1000, max_depth=7, learning_rate=0.05, min_child_samples=10: 0.7582

R^2 with n_estimators=1000, max_depth=7, learning_rate=0.1, min_child_samples=1: 0.7744

R^2 with n_estimators=1000, max_depth=7, learning_rate=0.1, min_child_samples=5: 0.7726

R^2 with n_estimators=1000, max_depth=7, learning_rate=0.1, min_child_samples=10: 0.7750

R^2 with n_estimators=1000, max_depth=10, learning_rate=0.01, min_child_samples=1: 0.6655

R^2 with n_estimators=1000, max_depth=10, learning_rate=0.01, min_child_samples=5: 0.6672

R^2 with n_estimators=1000, max_depth=10, learning_rate=0.01, min_child_samples=10: 0.6656

R^2 with n_estimators=1000, max_depth=10, learning_rate=0.05, min_child_samples=1: 0.7599

R^2 with n_estimators=1000, max_depth=10, learning_rate=0.05, min_child_samples=5: 0.7647

R^2 with n_estimators=1000, max_depth=10, learning_rate=0.05, min_child_samples=10: 0.7647

R^2 with n_estimators=1000, max_depth=10, learning_rate=0.1, min_child_samples=1: 0.7713

R^2 with n_estimators=1000, max_depth=10, learning_rate=0.1, min_child_samples=5: 0.7781

R^2 with n_estimators=1000, max_depth=10, learning_rate=0.1, min_child_samples=10: 0.7759

R^2 with n_estimators=1000, max_depth=15, learning_rate=0.01, min_child_samples=1: 0.6682

R^2 with n_estimators=1000, max_depth=15, learning_rate=0.01, min_child_samples=5: 0.6671

R^2 with n_estimators=1000, max_depth=15, learning_rate=0.01, min_child_samples=10: 0.6685

R^2 with n_estimators=1000, max_depth=15, learning_rate=0.05, min_child_samples=1: 0.7625

R^2 with n_estimators=1000, max_depth=15, learning_rate=0.05, min_child_samples=5: 0.7627

R^2 with n_estimators=1000, max_depth=15, learning_rate=0.05, min_child_samples=10: 0.7624

R^2 with n_estimators=1000, max_depth=15, learning_rate=0.1, min_child_samples=1: 0.7709

R^2 with n_estimators=1000, max_depth=15, learning_rate=0.1, min_child_samples=5: 0.7803

R^2 with n_estimators=1000, max_depth=15, learning_rate=0.1, min_child_samples=10: 0.7796

Best parameters found in the normalized dataset:

{'n_estimators': 1000, 'max_depth': 15, 'learning_rate': 0.1, 'min_child_samples': 5} 0.7803

2 General Benchmarks

```
========================================
TROPMOL BOITATÁ - RADIUS BENCHMARK
========================================
   Radius   Name   R2_Mean    R2_Std
2       3  ECFP6  0.783401  0.012422
1       2  ECFP4  0.781211  0.009154
0       1  ECFP2  0.767296  0.010752
----------------------------------------
```

```
========================================
TROPMOL BOITATÁ - BIT DENSITY REPORT
========================================
Total Valid Molecules: 16388
Fingerprint Size:      2048
----------------------------------------
Average ON Bits:       49.74
Bit Density:           2.4285%
========================================
STATUS: OPTIMAL. (Low risk of collision)
```

```
---  ANOTHER STATISTICAL PARAMETERS (30% test set) ---
Q²: 0.7370
------------------------------------------------
k (predicted vs. observed slope): 0.9993
k' (observed vs. predicted slope): 0.9859
------------------------------------------------
r²m (average): 0.5791
Δr²m: 0.3115
```