

ufw6pinxw

December 26, 2024

```
[199]: import pandas as pd
import numpy as np
import seaborn as sns
import warnings
warnings.filterwarnings('ignore',category=UserWarning)
from textblob import TextBlob
from xgboost import XGBRegressor
import matplotlib.pyplot as plt
from sklearn.pipeline import Pipeline
from sklearn.preprocessing import LabelEncoder, MinMaxScaler
from sklearn.ensemble import RandomForestRegressor
from sklearn.model_selection import train_test_split, GridSearchCV
from sklearn.model_selection import RandomizedSearchCV
from sklearn.metrics import mean_squared_error, r2_score
from sklearn.model_selection import train_test_split
from sklearn.model_selection import cross_val_score
from joblib import dump, load
from sklearn.metrics import mean_squared_error, mean_absolute_error, \
    explained_variance_score, median_absolute_error, mean_squared_log_error
```

```
[94]: df = pd.read_excel('Rotten_Tomatoes_Movies3.xls')
```

```
[95]: df.head()
```

```
[95]:
```

| | movie_title \ |
|---|---|
| 0 | Percy Jackson & the Olympians: The Lightning T... |
| 1 | Please Give |
| 2 | 10 |
| 3 | 12 Angry Men (Twelve Angry Men) |
| 4 | 20,000 Leagues Under The Sea |

| | movie_info \ |
|---|---|
| 0 | A teenager discovers he's the descendant of a ... |
| 1 | Kate has a lot on her mind. There's the ethics... |
| 2 | Blake Edwards' 10 stars Dudley Moore as George... |
| 3 | A Puerto Rican youth is on trial for murder, a... |
| 4 | This 1954 Disney version of Jules Verne's 20,0... |

```

                                critics_consensus rating \
0  Though it may seem like just another Harry Pot...    PG
1  Nicole Holofcener's newest might seem slight i...      R
2                                                    NaN      R
3  Sidney Lumet's feature debut is a superbly wri...    NR
4  One of Disney's finest live-action adventures,...      G

                                genre                directors \
0  Action & Adventure, Comedy, Drama, Science Fic...    Chris Columbus
1                                                    Comedy    Nicole Holofcener
2                                                    Comedy, Romance    Blake Edwards
3                                                    Classics, Drama        Sidney Lumet
4  Action & Adventure, Drama, Kids & Family    Richard Fleischer

                                writers                cast \
0  Craig Titley    Logan Lerman, Brandon T. Jackson, Alexandra Da...
1  Nicole Holofcener    Catherine Keener, Amanda Peet, Oliver Platt, R...
2  Blake Edwards    Dudley Moore, Bo Derek, Julie Andrews, Robert ...
3  Reginald Rose    Martin Balsam, John Fiedler, Lee J. Cobb, E.G...
4  Earl Felton    James Mason, Kirk Douglas, Paul Lukas, Peter L...

in_theaters_date on_streaming_date runtime_in_minutes \
0      2010-02-12      2010-06-29          83.0
1      2010-04-30      2010-10-19          90.0
2      1979-10-05      1997-08-27         118.0
3      1957-04-13      2001-03-06          95.0
4      1954-01-01      2003-05-20         127.0

                                studio_name tomatometer_status tomatometer_rating \
0      20th Century Fox                Rotten                49
1  Sony Pictures Classics    Certified Fresh                86
2      Waner Bros.                Fresh                68
3  Criterion Collection    Certified Fresh                100
4      Disney                Fresh                89

tomatometer_count audience_rating
0              144          53.0
1              140          64.0
2               22          53.0
3               51          97.0
4               27          74.0

```

```
[96]: df.shape
```

```
[96]: (16638, 16)
```

```
[97]: df.isna().sum()
```

```
[97]: movie_title      0
      movie_info      24
      critics_consensus 8329
      rating          0
      genre           17
      directors       114
      writers         1349
      cast            284
      in_theaters_date 815
      on_streaming_date 2
      runtime_in_minutes 155
      studio_name     416
      tomatometer_status 0
      tomatometer_rating 0
      tomatometer_count 0
      audience_rating 252
      dtype: int64
```

```
[98]: missing_summary = df.isnull().sum().sort_values(ascending=False)
      missing_percentage = (df.isnull().sum() / len(df) * 100).
      ↪sort_values(ascending=False)
      print(pd.DataFrame({'Missing Count': missing_summary, 'Missing %':
      ↪missing_percentage}))
```

| | Missing Count | Missing % |
|--------------------|---------------|-----------|
| critics_consensus | 8329 | 50.060103 |
| writers | 1349 | 8.107946 |
| in_theaters_date | 815 | 4.898425 |
| studio_name | 416 | 2.500301 |
| cast | 284 | 1.706936 |
| audience_rating | 252 | 1.514605 |
| runtime_in_minutes | 155 | 0.931602 |
| directors | 114 | 0.685179 |
| movie_info | 24 | 0.144248 |
| genre | 17 | 0.102176 |
| on_streaming_date | 2 | 0.012021 |
| movie_title | 0 | 0.000000 |
| rating | 0 | 0.000000 |
| tomatometer_status | 0 | 0.000000 |
| tomatometer_rating | 0 | 0.000000 |
| tomatometer_count | 0 | 0.000000 |

```
[99]: plt.figure(figsize=(12, 6))
      sns.heatmap(df.isna(), cbar=False, cmap="viridis")
      plt.title("Missing Values Heatmap")
```

```
plt.show()
```



```
[100]: df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 16638 entries, 0 to 16637
Data columns (total 16 columns):
#   Column                Non-Null Count  Dtype
---  -
0   movie_title            16638 non-null  object
1   movie_info             16614 non-null  object
2   critics_consensus      8309 non-null   object
3   rating                 16638 non-null  object
4   genre                  16621 non-null  object
5   directors              16524 non-null  object
6   writers                15289 non-null  object
7   cast                   16354 non-null  object
8   in_theaters_date       15823 non-null  datetime64[ns]
9   on_streaming_date      16636 non-null  datetime64[ns]
10  runtime_in_minutes     16483 non-null  float64
11  studio_name            16222 non-null  object
12  tomatometer_status     16638 non-null  object
13  tomatometer_rating     16638 non-null  int64
14  tomatometer_count      16638 non-null  int64
```

```

15  audience_rating      16386 non-null  float64
dtypes: datetime64[ns](2), float64(2), int64(2), object(10)
memory usage: 2.0+ MB

```

```
[101]: df.dtypes
```

```

[101]: movie_title      object
movie_info      object
critics_consensus  object
rating          object
genre           object
directors       object
writers         object
cast            object
in_theaters_date  datetime64[ns]
on_streaming_date  datetime64[ns]
runtime_in_minutes float64
studio_name      object
tomatometer_status object
tomatometer_rating int64
tomatometer_count int64
audience_rating  float64
dtype: object

```

```

[102]: df['movie_info'] = df['movie_info'].fillna('No info')
df['critics_consensus'] = df['critics_consensus'].fillna('No consensus')
df['genre'] = df['genre'].fillna('Unknown Genre')
df['directors'] = df['directors'].fillna('Unknown Director')
df['writers'] = df['writers'].fillna('Unknown Writers')
df['cast'] = df['cast'].fillna('Unknown Cast') # Replace missing cast info
df['in_theaters_date'] = df['in_theaters_date'].fillna(df['in_theaters_date'].
    ↪mode()[0])
df['on_streaming_date'] = df['on_streaming_date'].
    ↪fillna(df['on_streaming_date'].mode()[0])
df['runtime_in_minutes'] = df['runtime_in_minutes'].
    ↪fillna(df['runtime_in_minutes'].median())
df['studio_name'] = df['studio_name'].fillna('Unknown Studio')
df['audience_rating'] = df['audience_rating'].fillna(df['audience_rating'].
    ↪median())

```

```
[103]: df.describe()
```

```

[103]:               in_theaters_date               on_streaming_date  \
count                16638                16638
mean  1999-12-03 01:35:32.996754432  2008-08-13 09:10:11.467724288
min      1914-06-01 00:00:00      1935-06-06 00:00:00
25%      1994-06-01 00:00:00      2003-01-29 18:00:00

```

| | | |
|-----|---------------------|---------------------|
| 50% | 2005-09-16 00:00:00 | 2008-04-08 00:00:00 |
| 75% | 2013-03-22 00:00:00 | 2014-05-12 00:00:00 |
| max | 2019-12-07 00:00:00 | 2019-11-01 00:00:00 |
| std | NaN | NaN |

| | runtime_in_minutes | tomatometer_rating | tomatometer_count \ |
|-------|--------------------|--------------------|---------------------|
| count | 16638.000000 | 16638.000000 | 16638.000000 |
| mean | 102.359899 | 60.466522 | 56.607104 |
| min | 1.000000 | 0.000000 | 5.000000 |
| 25% | 90.000000 | 38.000000 | 12.000000 |
| 50% | 99.000000 | 66.000000 | 28.000000 |
| 75% | 111.000000 | 86.000000 | 76.000000 |
| max | 2000.000000 | 100.000000 | 497.000000 |
| std | 24.913281 | 28.587230 | 66.383800 |

| | audience_rating |
|-------|-----------------|
| count | 16638.000000 |
| mean | 60.493990 |
| min | 0.000000 |
| 25% | 45.000000 |
| 50% | 62.000000 |
| 75% | 77.000000 |
| max | 100.000000 |
| std | 20.307664 |

```
[104]: # Select only numerical columns
numerical_columns = df.select_dtypes(include=['float64', 'int64']).columns
numerical_df = df[numerical_columns]

# Calculate the correlation matrix
correlation_matrix = numerical_df.corr()

# Correlation with the target variable (audience_rating)
correlation_with_target = correlation_matrix['audience_rating'].
    ↪sort_values(ascending=False)
print(correlation_with_target)
```

```
audience_rating    1.000000
tomatometer_rating  0.655457
runtime_in_minutes  0.166238
tomatometer_count   0.139727
Name: audience_rating, dtype: float64
```

```
[105]: numeric_cols = df.select_dtypes(include=['number']).columns
```

```
[106]: numeric_cols
```

```
[106]: Index(['runtime_in_minutes', 'tomatometer_rating', 'tomatometer_count',  
          'audience_rating'],  
          dtype='object')
```

```
[107]: df_cleaned = df.copy()  
for col in numeric_cols:  
    Q1 = df[col].quantile(0.25)  
    Q3 = df[col].quantile(0.75)  
    IQR = Q3 - Q1  
    lower_bound = Q1 - 1.5 * IQR  
    upper_bound = Q3 + 1.5 * IQR  
    df_cleaned = df_cleaned[(df_cleaned[col] >= lower_bound) & (df_cleaned[col] ≤  
    ↪ ≤ upper_bound)]
```

```
[108]: df_cleaned.shape
```

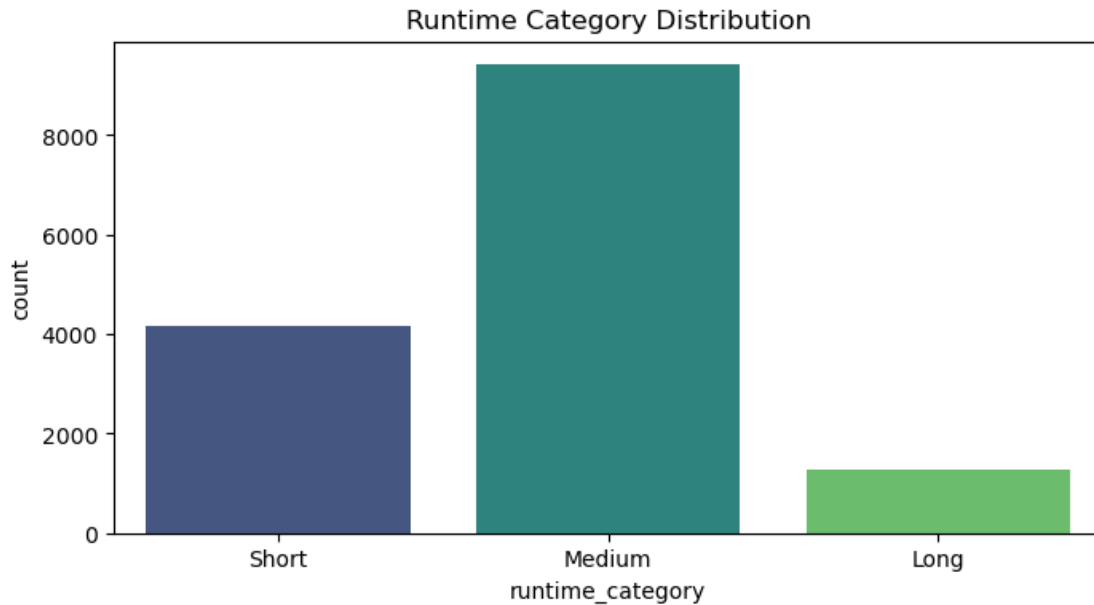
```
[108]: (14840, 16)
```

```
[109]: df_cleaned['runtime_category'] = pd.cut(  
    df_cleaned['runtime_in_minutes'], bins=[0, 90, 120, 180], labels=['Short',  
    ↪ 'Medium', 'Long']  
)
```

```
[110]: df_cleaned.runtime_category.value_counts()
```

```
[110]: runtime_category  
Medium    9415  
Short     4153  
Long      1272  
Name: count, dtype: int64
```

```
[111]: plt.figure(figsize=(8, 4))  
sns.countplot(data=df_cleaned, x='runtime_category', palette='viridis')  
plt.title("Runtime Category Distribution")  
plt.show()
```



```
[112]: df_cleaned['in_theaters_date'] = pd.to_datetime(df_cleaned['in_theaters_date'],
    ↪errors='coerce')
df_cleaned['on_streaming_date'] = pd.
    ↪to_datetime(df_cleaned['on_streaming_date'], errors='coerce')
df_cleaned['theater_year'] = df_cleaned['in_theaters_date'].dt.year
df_cleaned['theater_month'] = df_cleaned['in_theaters_date'].dt.month
df_cleaned['stream_year'] = df_cleaned['on_streaming_date'].dt.year
df_cleaned['stream_month'] = df_cleaned['on_streaming_date'].dt.month
```

```
[113]: df_cleaned['audience_to_critic_ratio'] = df_cleaned['audience_rating'] /
    ↪(df_cleaned['tomatometer_rating'] + 1) # Add 1 to avoid division by zero
df_cleaned['engagement_score'] = df_cleaned['tomatometer_count'] *
    ↪df_cleaned['audience_rating']
```

```
[114]: df_cleaned['cast_count'] = df_cleaned['cast'].apply(lambda x: len(x.split(',')))
```

```
[115]: df_cleaned['release_to_streaming_gap'] = (df_cleaned['on_streaming_date'] -
    ↪df_cleaned['in_theaters_date']).dt.days
```

```
[116]: df_cleaned['primary_genre'] = df_cleaned['genre'].apply(lambda x: x.
    ↪split(',')[0] if x else 'Unknown')
df_cleaned['secondary_genre'] = df_cleaned['genre'].apply(lambda x: x.
    ↪split(',')[1] if len(x.split(',')) > 1 else 'None')
```

```
[117]: if 'directors' in df_cleaned.columns and 'audience_rating' in df_cleaned.
    ↪columns:
```



```

df_cleaned['director_avg_rating'] = df_cleaned.
↳groupby('directors')['audience_rating'].transform('mean')

if 'primary_genre' in df_cleaned.columns and 'tomatometer_rating' in df_cleaned.
↳columns:
    df_cleaned['genre_avg_tomatometer'] = df_cleaned.
↳groupby('primary_genre')['tomatometer_rating'].transform('mean')

```

```

[118]: if 'release_year' in df_cleaned.columns:
        df_cleaned['release_decade'] = (df_cleaned['release_year'] // 10) * 10

```

```

[119]: df_cleaned['movie_info_sentiment'] = df_cleaned['movie_info'].fillna('').
        ↳apply(lambda x: TextBlob(x).sentiment.polarity)

```

```

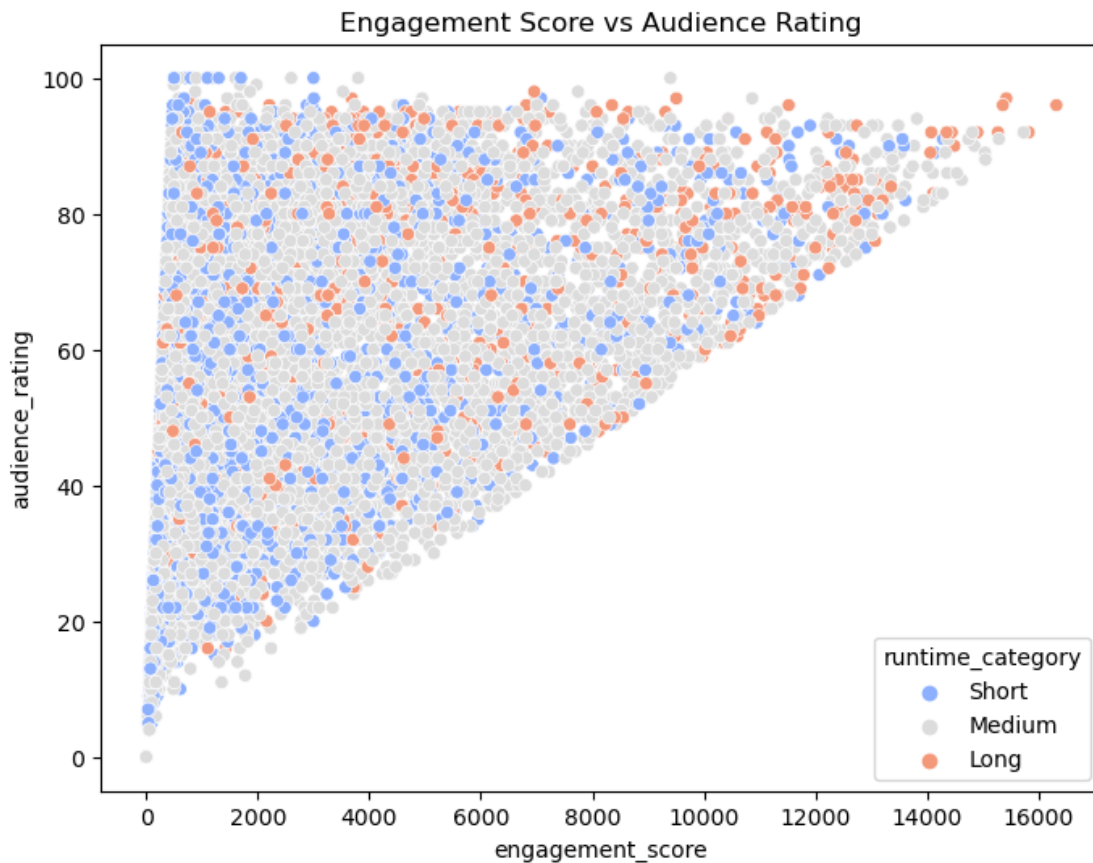
[120]: df_cleaned['critics_consensus_sentiment'] = df_cleaned['critics_consensus'].
        ↳fillna('').apply(lambda x: TextBlob(x).sentiment.polarity)

```

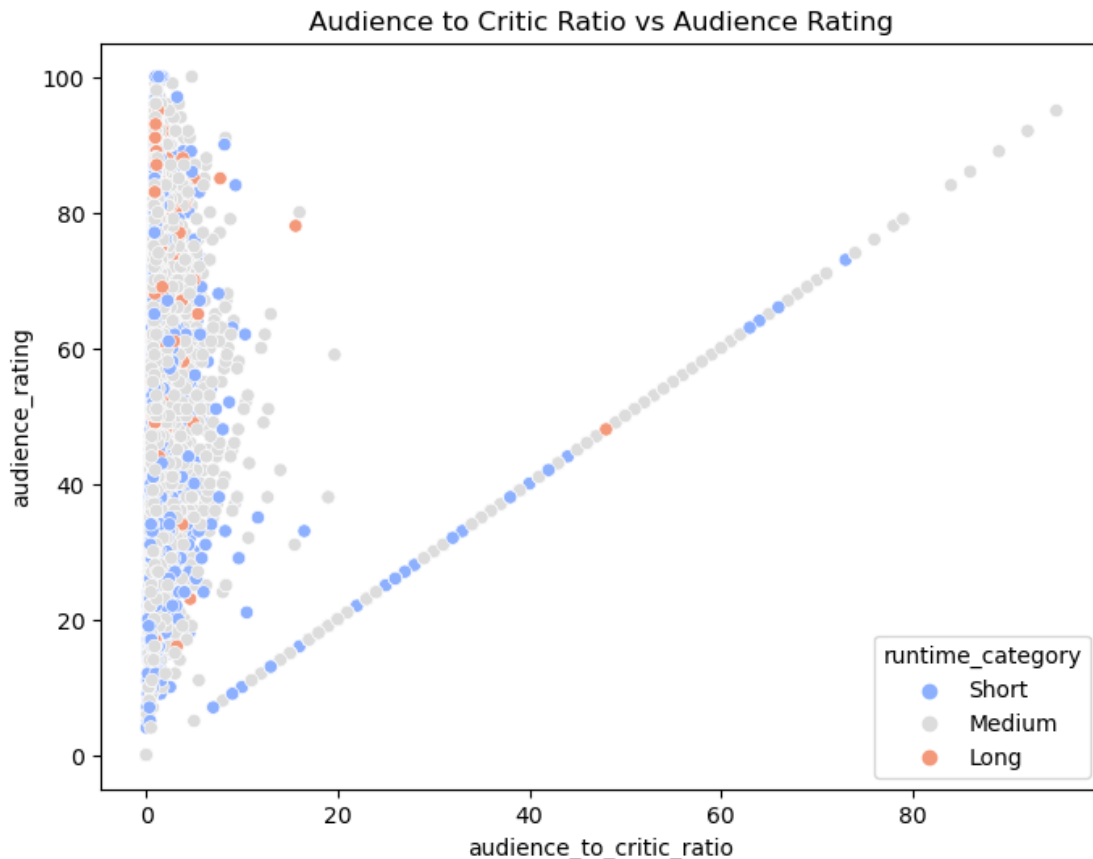
```

[121]: plt.figure(figsize=(8, 6))
        sns.scatterplot(data=df_cleaned, x='engagement_score', y='audience_rating',
        ↳hue='runtime_category', palette='coolwarm')
        plt.title("Engagement Score vs Audience Rating")
        plt.show()

```



```
[122]: plt.figure(figsize=(8, 6))
sns.scatterplot(data=df_cleaned, x='audience_to_critic_ratio',
               y='audience_rating', hue='runtime_category', palette='coolwarm')
plt.title("Audience to Critic Ratio vs Audience Rating")
plt.show()
```



```
[123]: df_cleaned.columns
```

```
[123]: Index(['movie_title', 'movie_info', 'critics_consensus', 'rating', 'genre',
             'directors', 'writers', 'cast', 'in_theaters_date', 'on_streaming_date',
             'runtime_in_minutes', 'studio_name', 'tomatometer_status',
             'tomatometer_rating', 'tomatometer_count', 'audience_rating',
             'runtime_category', 'theater_year', 'theater_month', 'stream_year',
             'stream_month', 'audience_to_critic_ratio', 'engagement_score',
             'cast_count', 'release_to_streaming_gap', 'primary_genre',
             'secondary_genre', 'director_avg_rating', 'genre_avg_tomatometer',
             'movie_info_sentiment', 'critics_consensus_sentiment'],
            dtype='object')
```

```
dtype='object')
```

```
[ ]:
```

```
[124]: columns_to_drop = [  
        'movie_title',  
        'movie_info', 'critics_consensus',  
        'genre',  
        'directors', 'writers', 'studio_name',  
        'director_avg_rating', 'studio_avg_rating',  
        'cast'  
    ]
```

```
[125]: df_final = df_cleaned.drop(columns=columns_to_drop, errors='ignore')
```

```
[126]: cat_columns = ['rating', 'tomatometer_status', 'primary_genre',  
                    ↪ 'secondary_genre', 'runtime_category']
```

```
[127]: label_encoders = {}  
for col in cat_columns:  
    le = LabelEncoder()  
    df_final[col] = le.fit_transform(df_final[col].astype(str))  
    label_encoders[col] = le
```

```
[128]: scaler = MinMaxScaler()
```

```
[129]: scaler = MinMaxScaler()  
df_final[cat_columns] = scaler.fit_transform(df_final[cat_columns])
```

```
[130]: datetime_cols = df_final.select_dtypes(include=['datetime64']).columns
```

```
[131]: df_final = df_final.drop(columns=datetime_cols)
```

```
[132]: X = df_final.drop(columns=['audience_rating'])  
y = df_final['audience_rating']
```

```
[133]: X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2,  
                    ↪ random_state=42)
```

```
[134]: rf_model = RandomForestRegressor(random_state=42)
```

```
[135]: rf_model.fit(X_train, y_train)
```

```
[135]: RandomForestRegressor(random_state=42)
```

```
[136]: y_pred = rf_model.predict(X_test)
```

```
[137]: rmse = mean_squared_error(y_test, y_pred, squared=False)
r2 = r2_score(y_test, y_pred)
```

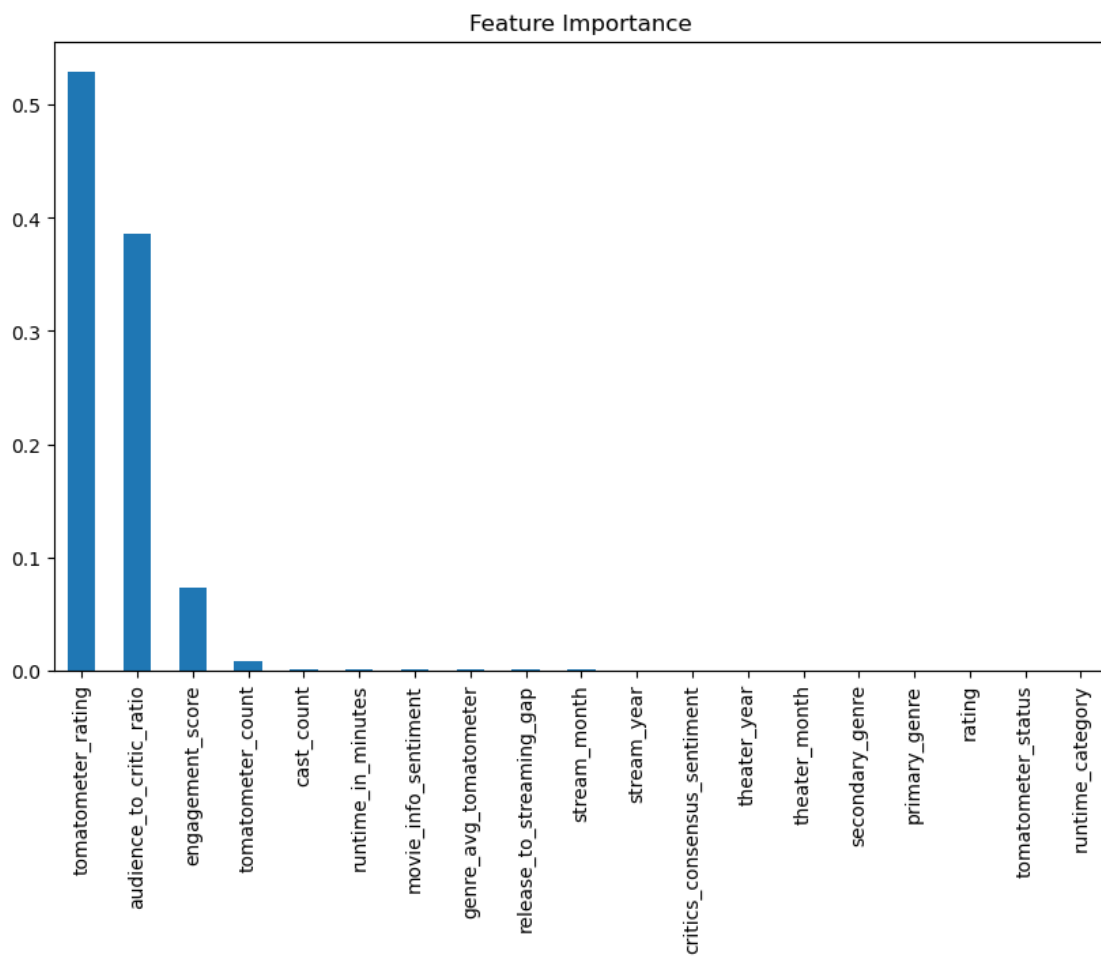
```
[138]: print(f"RMSE: {rmse}")
print(f"R^2 Score: {r2}")
```

RMSE: 0.9529666404390856

R² Score: 0.9977941454798055

```
[139]: feature_importance = pd.Series(rf_model.feature_importances_, index=X.columns).
      ↪sort_values(ascending=False)
```

```
# Plot feature importance
plt.figure(figsize=(10, 6))
feature_importance.plot(kind='bar')
plt.title("Feature Importance")
plt.show()
```



```
[140]: # Predict on the training data
y_train_pred = rf_model.predict(X_train)

# Calculate RMSE and R² for training data
rmse_train = mean_squared_error(y_train, y_train_pred, squared=False)
r2_train = r2_score(y_train, y_train_pred)

print(f"Training RMSE: {rmse_train}")
print(f"Training R²: {r2_train}")
```

Training RMSE: 0.34814004495743517

Training R²: 0.9997078861744478

```
[141]: # Predict on the test data
y_test_pred = rf_model.predict(X_test)

# Calculate RMSE and R² for test data
rmse_test = mean_squared_error(y_test, y_test_pred, squared=False)
r2_test = r2_score(y_test, y_test_pred)

print(f"Test RMSE: {rmse_test}")
print(f"Test R²: {r2_test}")
```

Test RMSE: 0.9529666404390856

Test R²: 0.9977941454798055

```
[142]: low_importance_features = [
    'runtime_category', 'primary_genre', 'stream_month', 'stream_year',
    'theater_month', 'theater_year', 'secondary_genre', 'rating',
    'tomatometer_status'
]
```

```
[143]: df_final = df_final.drop(columns=low_importance_features)
```

```
[144]: X = df_final.drop(columns=['audience_rating'])
y = df_final['audience_rating']
```

```
[191]: X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2,
    ↪ random_state=42)
rf_model.fit(X_train, y_train)
```

```
[191]: RandomForestRegressor(random_state=42)
```

```
[192]: rmse = mean_squared_error(y_test, y_pred, squared=False)
mae = mean_absolute_error(y_test, y_pred)
medae = median_absolute_error(y_test, y_pred)
msle = mean_squared_log_error(y_test, y_pred)
```

```

explained_var = explained_variance_score(y_test, y_pred)
r2 = r2_score(y_test, y_pred)
# Print metrics
print(f"Root Mean Squared Error (RMSE): {rmse}")
print(f"Mean Absolute Error (MAE): {mae}")
print(f"Median Absolute Error: {medae}")
print(f"Mean Squared Logarithmic Error (MSLE): {msle}")
print(f"Explained Variance Score: {explained_var}")
print(f"Explained R2 score: {r2}")

```

Root Mean Squared Error (RMSE): 0.9080055192073732
 Mean Absolute Error (MAE): 0.3438847708894881
 Median Absolute Error: 0.140000000000000057
 Mean Squared Logarithmic Error (MSLE): 0.002106972611279203
 Explained Variance Score: 0.9980000530150415
 Explained R² score: 0.9979973804694764

```

[193]: # Predict on the training data
y_train_pred = rf_model.predict(X_train)

# Calculate RMSE and R2 for training data
rmse_train = mean_squared_error(y_train, y_train_pred, squared=False)
r2_train = r2_score(y_train, y_train_pred)

print(f"Training RMSE: {rmse_train}")
print(f"Training R2: {r2_train}")

```

Training RMSE: 0.33000638113572367
 Training R²: 0.9997375244674849

```

[194]: # Predict on the test data
y_test_pred = rf_model.predict(X_test)

# Calculate RMSE and R2 for test data
rmse_test = mean_squared_error(y_test, y_test_pred, squared=False)
r2_test = r2_score(y_test, y_test_pred)

print(f"Test RMSE: {rmse_test}")
print(f"Test R2: {r2_test}")

```

Test RMSE: 0.9080055192073732
 Test R²: 0.9979973804694764

```

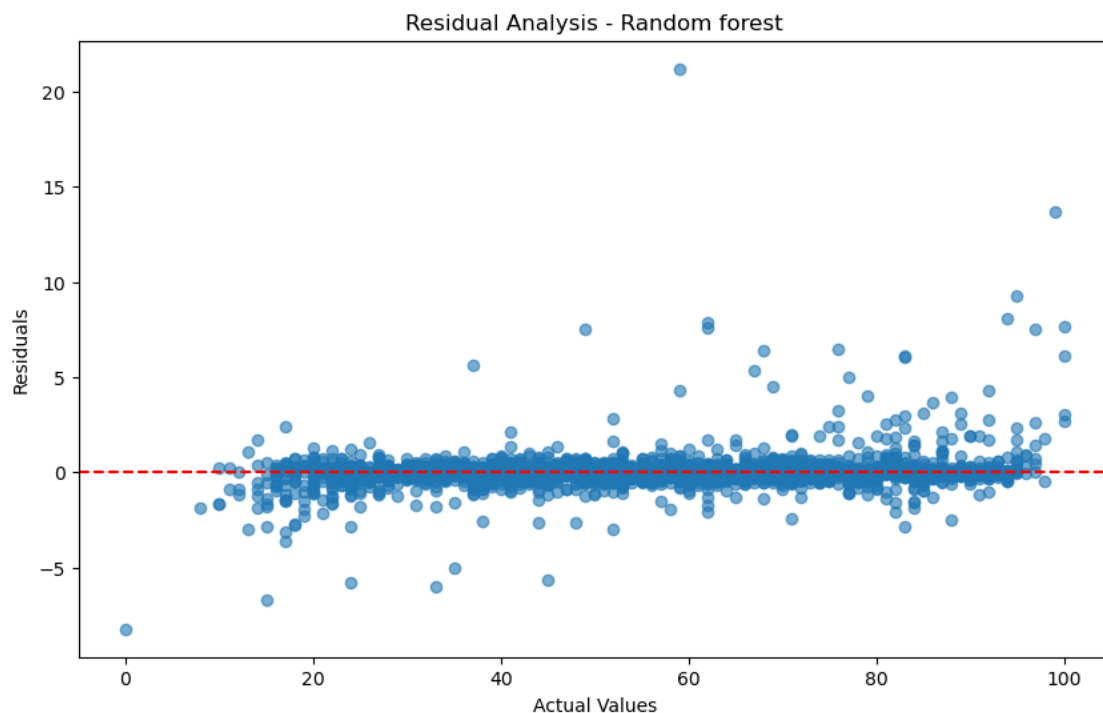
[147]: cv_scores = cross_val_score(rf_model, X, y, cv=5,
    ↪scoring='neg_mean_squared_error')
rmse_cv = (-cv_scores.mean()) ** 0.5
print(f"Cross-Validation RMSE: {rmse_cv}")

```

Cross-Validation RMSE: 0.9198487695051334

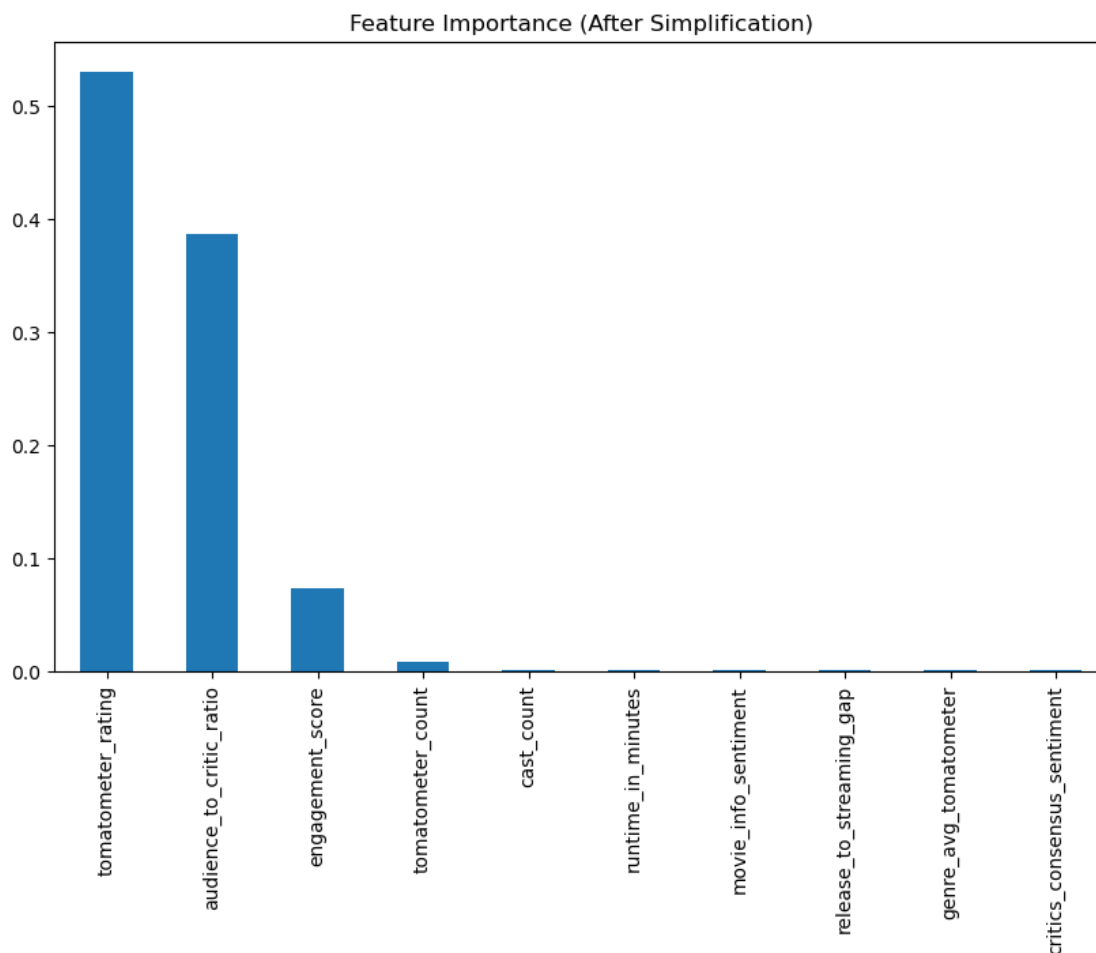
```
[183]: residuals = y_test - rf_model.predict(X_test)

# Plot residuals
plt.figure(figsize=(10, 6))
plt.scatter(y_test, residuals, alpha=0.6)
plt.axhline(y=0, color='r', linestyle='--')
plt.xlabel('Actual Values')
plt.ylabel('Residuals')
plt.title('Residual Analysis - Random forest')
plt.show()
```



```
[184]: feature_importance = pd.Series(rf_model.feature_importances_, index=X.columns).
      ↪ sort_values(ascending=False)

plt.figure(figsize=(10, 6))
feature_importance.plot(kind='bar')
plt.title("Feature Importance (After Simplification)")
plt.show()
```



```
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=100; total time= 1.1s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=100; total time= 1.1s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=100; total time= 1.2s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=200; total time= 2.3s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=200; total time= 2.2s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=200; total time= 2.2s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=300; total time= 3.4s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=300; total time= 3.4s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time= 1.1s
```



```
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,  
min_samples_split=2, n_estimators=200; total time=   1.9s  
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,  
min_samples_split=5, n_estimators=100; total time=    0.9s  
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,  
min_samples_split=5, n_estimators=300; total time=    2.6s  
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,  
min_samples_split=10, n_estimators=300; total time=    2.7s  
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,  
min_samples_split=2, n_estimators=100; total time=    1.3s  
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,  
min_samples_split=2, n_estimators=200; total time=    2.7s  
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,  
min_samples_split=2, n_estimators=200; total time=    2.5s  
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,  
min_samples_split=2, n_estimators=200; total time=    2.6s  
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,  
min_samples_split=10, n_estimators=100; total time=    1.3s  
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,  
min_samples_split=10, n_estimators=100; total time=    1.1s  
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,  
min_samples_split=10, n_estimators=100; total time=    1.2s  
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,  
min_samples_split=10, n_estimators=200; total time=    2.3s  
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,  
min_samples_split=2, n_estimators=300; total time=    4.3s  
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,  
min_samples_split=5, n_estimators=100; total time=    1.3s  
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,  
min_samples_split=5, n_estimators=100; total time=    1.3s  
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,  
min_samples_split=5, n_estimators=100; total time=    1.3s  
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,  
min_samples_split=5, n_estimators=200; total time=    2.7s  
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,  
min_samples_split=5, n_estimators=200; total time=    2.7s  
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,  
min_samples_split=5, n_estimators=200; total time=    2.6s  
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,  
min_samples_split=5, n_estimators=300; total time=    4.0s  
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,  
min_samples_split=5, n_estimators=100; total time=    1.1s  
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,  
min_samples_split=5, n_estimators=100; total time=    1.1s  
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,  
min_samples_split=5, n_estimators=200; total time=    2.2s  
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,  
min samples split=5, n estimators=200; total time=    2.4s
```

[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
 min_samples_split=5, n_estimators=200; total time= 2.2s
 [CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
 min_samples_split=5, n_estimators=300; total time= 3.3s
 [CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
 min_samples_split=5, n_estimators=300; total time= 3.4s
 [CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
 min_samples_split=5, n_estimators=300; total time= 3.4s
 [CV] END max_depth=30, max_features=sqrt, min_samples_leaf=2,
 min_samples_split=2, n_estimators=300; total time= 3.9s
 [CV] END max_depth=30, max_features=sqrt, min_samples_leaf=2,
 min_samples_split=2, n_estimators=300; total time= 4.0s
 [CV] END max_depth=30, max_features=sqrt, min_samples_leaf=2,
 min_samples_split=5, n_estimators=100; total time= 1.2s
 [CV] END max_depth=30, max_features=sqrt, min_samples_leaf=2,
 min_samples_split=5, n_estimators=100; total time= 1.2s
 [CV] END max_depth=30, max_features=sqrt, min_samples_leaf=4,
 min_samples_split=2, n_estimators=300; total time= 3.3s
 [CV] END max_depth=30, max_features=sqrt, min_samples_leaf=4,
 min_samples_split=5, n_estimators=100; total time= 1.1s
 [CV] END max_depth=30, max_features=sqrt, min_samples_leaf=4,
 min_samples_split=5, n_estimators=100; total time= 1.1s
 [CV] END max_depth=30, max_features=sqrt, min_samples_leaf=4,
 min_samples_split=5, n_estimators=100; total time= 1.1s
 [CV] END max_depth=30, max_features=sqrt, min_samples_leaf=4,
 min_samples_split=10, n_estimators=300; total time= 3.4s
 [CV] END max_depth=30, max_features=log2, min_samples_leaf=1,
 min_samples_split=2, n_estimators=300; total time= 4.4s
 [CV] END max_depth=30, max_features=log2, min_samples_leaf=1,
 min_samples_split=10, n_estimators=200; total time= 2.4s
 [CV] END max_depth=30, max_features=log2, min_samples_leaf=2,
 min_samples_split=2, n_estimators=100; total time= 1.4s
 [CV] END max_depth=30, max_features=log2, min_samples_leaf=2,
 min_samples_split=2, n_estimators=300; total time= 3.9s
 [CV] END max_depth=30, max_features=log2, min_samples_leaf=2,
 min_samples_split=10, n_estimators=100; total time= 1.1s
 [CV] END max_depth=30, max_features=log2, min_samples_leaf=2,
 min_samples_split=10, n_estimators=200; total time= 2.4s
 [CV] END max_depth=30, max_features=log2, min_samples_leaf=4,
 min_samples_split=2, n_estimators=200; total time= 2.2s
 [CV] END max_depth=30, max_features=log2, min_samples_leaf=4,
 min_samples_split=5, n_estimators=100; total time= 1.1s
 [CV] END max_depth=30, max_features=log2, min_samples_leaf=4,
 min_samples_split=5, n_estimators=300; total time= 3.3s
 [CV] END max_depth=30, max_features=log2, min_samples_leaf=4,
 min_samples_split=10, n_estimators=300; total time= 2.7s
 [CV] END bootstrap=False, max_depth=None, max_features=sqrt, min_samples_leaf=2,
 min_samples_split=2, n_estimators=100; total time= 2.1s

[CV] END bootstrap=False, max_depth=None, max_features=sqrt, min_samples_leaf=2, min_samples_split=2, n_estimators=100; total time= 1.9s

[CV] END bootstrap=False, max_depth=40, max_features=log2, min_samples_leaf=1, min_samples_split=5, n_estimators=500; total time= 10.1s

[CV] END bootstrap=False, max_depth=None, max_features=log2, min_samples_leaf=2, min_samples_split=10, n_estimators=300; total time= 5.5s

[CV] END bootstrap=True, max_depth=10, max_features=sqrt, min_samples_leaf=2, min_samples_split=2, n_estimators=300; total time= 2.7s

[CV] END bootstrap=True, max_depth=40, max_features=sqrt, min_samples_leaf=4, min_samples_split=2, n_estimators=500; total time= 5.5s

[CV] END bootstrap=True, max_depth=30, max_features=sqrt, min_samples_leaf=4, min_samples_split=5, n_estimators=100; total time= 1.1s

[CV] END bootstrap=False, max_depth=20, max_features=log2, min_samples_leaf=1, min_samples_split=10, n_estimators=200; total time= 3.7s

[CV] END bootstrap=True, max_depth=None, max_features=sqrt, min_samples_leaf=2, min_samples_split=2, n_estimators=500; total time= 6.3s

[CV] END bootstrap=True, max_depth=20, max_features=log2, min_samples_leaf=2, min_samples_split=10, n_estimators=200; total time= 2.2s

[CV] END bootstrap=False, max_depth=40, max_features=log2, min_samples_leaf=4, min_samples_split=10, n_estimators=100; total time= 1.6s

[CV] END bootstrap=False, max_depth=10, max_features=sqrt, min_samples_leaf=2, min_samples_split=10, n_estimators=300; total time= 3.7s

[CV] END bootstrap=True, max_depth=10, max_features=log2, min_samples_leaf=2, min_samples_split=2, n_estimators=100; total time= 1.0s

[CV] END bootstrap=True, max_depth=30, max_features=sqrt, min_samples_leaf=2, min_samples_split=10, n_estimators=200; total time= 2.4s

[CV] END bootstrap=False, max_depth=None, max_features=log2, min_samples_leaf=1, min_samples_split=10, n_estimators=200; total time= 3.5s

[CV] END bootstrap=False, max_depth=10, max_features=auto, min_samples_leaf=2, min_samples_split=2, n_estimators=100; total time= 0.0s

[CV] END bootstrap=False, max_depth=10, max_features=auto, min_samples_leaf=2, min_samples_split=2, n_estimators=100; total time= 0.0s

[CV] END bootstrap=False, max_depth=10, max_features=auto, min_samples_leaf=2, min_samples_split=2, n_estimators=100; total time= 0.0s

[CV] END bootstrap=True, max_depth=40, max_features=auto, min_samples_leaf=2, min_samples_split=10, n_estimators=200; total time= 0.0s

[CV] END bootstrap=True, max_depth=40, max_features=auto, min_samples_leaf=2, min_samples_split=10, n_estimators=200; total time= 0.0s

[CV] END bootstrap=True, max_depth=40, max_features=auto, min_samples_leaf=2, min_samples_split=10, n_estimators=200; total time= 0.0s

[CV] END bootstrap=False, max_depth=30, max_features=auto, min_samples_leaf=2, min_samples_split=5, n_estimators=300; total time= 0.0s

[CV] END bootstrap=False, max_depth=30, max_features=auto, min_samples_leaf=2, min_samples_split=5, n_estimators=300; total time= 0.0s

[CV] END bootstrap=False, max_depth=30, max_features=auto, min_samples_leaf=2, min_samples_split=5, n_estimators=300; total time= 0.0s

[CV] END bootstrap=True, max_depth=40, max_features=auto, min_samples_leaf=1, min_samples_split=10, n_estimators=100; total time= 0.0s

[CV] END bootstrap=True, max_depth=40, max_features=auto, min_samples_leaf=1, min_samples_split=10, n_estimators=100; total time= 0.0s

[CV] END bootstrap=True, max_depth=40, max_features=auto, min_samples_leaf=1, min_samples_split=10, n_estimators=100; total time= 0.0s

[CV] END bootstrap=False, max_depth=40, max_features=log2, min_samples_leaf=2, min_samples_split=5, n_estimators=300; total time= 5.7s

[CV] END bootstrap=False, max_depth=20, max_features=sqrt, min_samples_leaf=4, min_samples_split=2, n_estimators=500; total time= 8.6s

[CV] END bootstrap=True, max_depth=30, max_features=sqrt, min_samples_leaf=2, min_samples_split=5, n_estimators=200; total time= 2.4s

[CV] END bootstrap=False, max_depth=None, max_features=sqrt, min_samples_leaf=1, min_samples_split=2, n_estimators=300; total time= 6.6s

[CV] END bootstrap=False, max_depth=30, max_features=log2, min_samples_leaf=1, min_samples_split=10, n_estimators=200; total time= 3.6s

[CV] END bootstrap=True, max_depth=None, max_features=sqrt, min_samples_leaf=2, min_samples_split=10, n_estimators=500; total time= 5.8s

[CV] END bootstrap=True, max_depth=30, max_features=auto, min_samples_leaf=4, min_samples_split=2, n_estimators=500; total time= 0.0s

[CV] END bootstrap=True, max_depth=30, max_features=auto, min_samples_leaf=4, min_samples_split=2, n_estimators=500; total time= 0.0s

[CV] END bootstrap=True, max_depth=30, max_features=auto, min_samples_leaf=4, min_samples_split=2, n_estimators=500; total time= 0.0s

[CV] END bootstrap=False, max_depth=10, max_features=sqrt, min_samples_leaf=4, min_samples_split=10, n_estimators=300; total time= 3.8s

[CV] END bootstrap=False, max_depth=30, max_features=sqrt, min_samples_leaf=1, min_samples_split=5, n_estimators=100; total time= 2.0s

[CV] END bootstrap=True, max_depth=40, max_features=auto, min_samples_leaf=1, min_samples_split=5, n_estimators=500; total time= 0.0s

[CV] END bootstrap=True, max_depth=40, max_features=auto, min_samples_leaf=1, min_samples_split=5, n_estimators=500; total time= 0.0s

[CV] END bootstrap=True, max_depth=40, max_features=auto, min_samples_leaf=1, min_samples_split=5, n_estimators=500; total time= 0.0s

[CV] END bootstrap=True, max_depth=30, max_features=auto, min_samples_leaf=4, min_samples_split=5, n_estimators=500; total time= 0.0s

[CV] END bootstrap=True, max_depth=30, max_features=auto, min_samples_leaf=4, min_samples_split=5, n_estimators=500; total time= 0.0s

[CV] END bootstrap=True, max_depth=30, max_features=auto, min_samples_leaf=4, min_samples_split=5, n_estimators=500; total time= 0.0s

[CV] END bootstrap=False, max_depth=40, max_features=sqrt, min_samples_leaf=4, min_samples_split=5, n_estimators=500; total time= 7.8s

[CV] END colsample_bytree=0.8, learning_rate=0.2, max_depth=3, n_estimators=300, reg_alpha=0.1, reg_lambda=1.5, subsample=1.0; total time= 0.1s

[CV] END colsample_bytree=0.8, learning_rate=0.2, max_depth=3, n_estimators=300, reg_alpha=0.1, reg_lambda=1.5, subsample=1.0; total time= 0.1s

[CV] END colsample_bytree=0.6, learning_rate=0.05, max_depth=3, n_estimators=200, reg_alpha=0, reg_lambda=2, subsample=0.8; total time= 0.1s

[CV] END colsample_bytree=1.0, learning_rate=0.1, max_depth=3, n_estimators=500, reg_alpha=1, reg_lambda=2, subsample=0.8; total time= 0.3s

[CV] END colsample_bytree=0.8, learning_rate=0.2, max_depth=10,
 n_estimators=500, reg_alpha=0.1, reg_lambda=2, subsample=0.6; total time= 3.1s
 [CV] END colsample_bytree=0.8, learning_rate=0.05, max_depth=7,
 n_estimators=100, reg_alpha=0.1, reg_lambda=2, subsample=0.6; total time= 0.2s
 [CV] END colsample_bytree=0.8, learning_rate=0.05, max_depth=7,
 n_estimators=300, reg_alpha=0, reg_lambda=1.5, subsample=0.6; total time= 0.7s
 [CV] END colsample_bytree=0.6, learning_rate=0.1, max_depth=7, n_estimators=500,
 reg_alpha=1, reg_lambda=1.5, subsample=1.0; total time= 1.1s
 [CV] END colsample_bytree=1.0, learning_rate=0.05, max_depth=7,
 n_estimators=100, reg_alpha=0.1, reg_lambda=1.5, subsample=0.8; total time=
 0.3s
 [CV] END colsample_bytree=0.8, learning_rate=0.1, max_depth=7, n_estimators=500,
 reg_alpha=0.1, reg_lambda=2, subsample=0.6; total time= 1.3s
 [CV] END colsample_bytree=0.8, learning_rate=0.1, max_depth=5, n_estimators=200,
 reg_alpha=1, reg_lambda=1, subsample=1.0; total time= 0.2s
 [CV] END colsample_bytree=0.8, learning_rate=0.1, max_depth=5, n_estimators=200,
 reg_alpha=1, reg_lambda=1, subsample=1.0; total time= 0.2s
 [CV] END colsample_bytree=0.6, learning_rate=0.1, max_depth=5, n_estimators=100,
 reg_alpha=0, reg_lambda=1.5, subsample=0.6; total time= 0.1s
 [CV] END colsample_bytree=0.8, learning_rate=0.01, max_depth=3,
 n_estimators=300, reg_alpha=1, reg_lambda=2, subsample=0.6; total time= 0.2s
 [CV] END colsample_bytree=0.6, learning_rate=0.01, max_depth=5,
 n_estimators=500, reg_alpha=0, reg_lambda=1, subsample=0.6; total time= 0.4s
 [CV] END colsample_bytree=0.8, learning_rate=0.1, max_depth=5, n_estimators=200,
 reg_alpha=0, reg_lambda=2, subsample=0.8; total time= 0.2s
 [CV] END colsample_bytree=1.0, learning_rate=0.1, max_depth=10,
 n_estimators=100, reg_alpha=0.1, reg_lambda=1.5, subsample=1.0; total time=
 0.7s
 [CV] END colsample_bytree=0.6, learning_rate=0.1, max_depth=10,
 n_estimators=300, reg_alpha=1, reg_lambda=2, subsample=0.8; total time= 1.7s
 [CV] END colsample_bytree=0.8, learning_rate=0.1, max_depth=7, n_estimators=300,
 reg_alpha=1, reg_lambda=2, subsample=1.0; total time= 0.6s
 [CV] END colsample_bytree=0.6, learning_rate=0.05, max_depth=5,
 n_estimators=300, reg_alpha=0, reg_lambda=2, subsample=0.6; total time= 0.3s
 [CV] END colsample_bytree=0.8, learning_rate=0.01, max_depth=10,
 n_estimators=100, reg_alpha=0.1, reg_lambda=1, subsample=0.6; total time= 0.7s
 [CV] END colsample_bytree=0.8, learning_rate=0.1, max_depth=3, n_estimators=100,
 reg_alpha=1, reg_lambda=1, subsample=1.0; total time= 0.1s
 [CV] END colsample_bytree=0.6, learning_rate=0.2, max_depth=3, n_estimators=300,
 reg_alpha=0.1, reg_lambda=1.5, subsample=0.8; total time= 0.2s
 [CV] END colsample_bytree=0.8, learning_rate=0.05, max_depth=10,
 n_estimators=300, reg_alpha=1, reg_lambda=1, subsample=0.6; total time= 1.5s
 [CV] END colsample_bytree=0.8, learning_rate=0.2, max_depth=3, n_estimators=300,
 reg_alpha=0.1, reg_lambda=1.5, subsample=1.0; total time= 0.1s
 [CV] END colsample_bytree=0.8, learning_rate=0.2, max_depth=3, n_estimators=300,
 reg_alpha=0.1, reg_lambda=1.5, subsample=1.0; total time= 0.1s
 [CV] END colsample_bytree=0.6, learning_rate=0.05, max_depth=3,
 n_estimators=200, reg_alpha=0, reg_lambda=2, subsample=0.8; total time= 0.1s

[CV] END colsample_bytree=1.0, learning_rate=0.1, max_depth=3, n_estimators=500, reg_alpha=1, reg_lambda=2, subsample=0.8; total time= 0.3s

[CV] END colsample_bytree=0.8, learning_rate=0.2, max_depth=10, n_estimators=500, reg_alpha=0.1, reg_lambda=2, subsample=0.6; total time= 3.2s

[CV] END colsample_bytree=0.8, learning_rate=0.05, max_depth=7, n_estimators=100, reg_alpha=0.1, reg_lambda=2, subsample=0.6; total time= 0.3s

[CV] END colsample_bytree=0.8, learning_rate=0.05, max_depth=7, n_estimators=100, reg_alpha=0.1, reg_lambda=2, subsample=0.6; total time= 0.2s

[CV] END colsample_bytree=0.8, learning_rate=0.05, max_depth=7, n_estimators=300, reg_alpha=0, reg_lambda=1.5, subsample=0.6; total time= 0.6s

[CV] END colsample_bytree=1.0, learning_rate=0.1, max_depth=7, n_estimators=100, reg_alpha=1, reg_lambda=1, subsample=0.8; total time= 0.2s

[CV] END colsample_bytree=1.0, learning_rate=0.1, max_depth=7, n_estimators=100, reg_alpha=1, reg_lambda=1, subsample=0.8; total time= 0.3s

[CV] END colsample_bytree=0.8, learning_rate=0.2, max_depth=10, n_estimators=200, reg_alpha=0.1, reg_lambda=1, subsample=0.8; total time= 1.6s

[CV] END colsample_bytree=0.8, learning_rate=0.01, max_depth=7, n_estimators=500, reg_alpha=1, reg_lambda=1.5, subsample=0.8; total time= 1.4s

[CV] END colsample_bytree=0.6, learning_rate=0.01, max_depth=5, n_estimators=500, reg_alpha=0, reg_lambda=1, subsample=0.6; total time= 0.5s

[CV] END colsample_bytree=1.0, learning_rate=0.1, max_depth=10, n_estimators=100, reg_alpha=0.1, reg_lambda=1.5, subsample=1.0; total time= 0.8s

[CV] END colsample_bytree=0.6, learning_rate=0.1, max_depth=10, n_estimators=300, reg_alpha=1, reg_lambda=2, subsample=0.8; total time= 1.6s

[CV] END colsample_bytree=0.6, learning_rate=0.05, max_depth=5, n_estimators=500, reg_alpha=1, reg_lambda=2, subsample=0.8; total time= 0.5s

[CV] END colsample_bytree=0.8, learning_rate=0.05, max_depth=7, n_estimators=300, reg_alpha=0, reg_lambda=1.5, subsample=1.0; total time= 0.6s

[CV] END colsample_bytree=0.6, learning_rate=0.01, max_depth=7, n_estimators=100, reg_alpha=1, reg_lambda=2, subsample=0.8; total time= 0.3s

[CV] END colsample_bytree=0.6, learning_rate=0.01, max_depth=7, n_estimators=100, reg_alpha=1, reg_lambda=2, subsample=0.8; total time= 0.2s

[CV] END colsample_bytree=0.8, learning_rate=0.1, max_depth=7, n_estimators=100, reg_alpha=0.1, reg_lambda=2, subsample=0.8; total time= 0.2s

[CV] END colsample_bytree=0.6, learning_rate=0.2, max_depth=3, n_estimators=300, reg_alpha=0.1, reg_lambda=1.5, subsample=0.8; total time= 0.2s

[CV] END colsample_bytree=0.6, learning_rate=0.2, max_depth=5, n_estimators=300, reg_alpha=1, reg_lambda=1, subsample=1.0; total time= 0.2s

[CV] END max_depth=30, max_features=sqrt, min_samples_leaf=1, min_samples_split=5, n_estimators=100; total time= 1.3s

[CV] END max_depth=30, max_features=sqrt, min_samples_leaf=1, min_samples_split=5, n_estimators=100; total time= 1.3s

[CV] END max_depth=30, max_features=sqrt, min_samples_leaf=1, min_samples_split=5, n_estimators=200; total time= 2.6s

[CV] END max_depth=30, max_features=sqrt, min_samples_leaf=1, min_samples_split=5, n_estimators=200; total time= 2.6s

[CV] END max_depth=30, max_features=sqrt, min_samples_leaf=2,

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min_samples_split=5, n_estimators=300; total time= 3.8s
[CV] END max_depth=30, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time= 3.8s
[CV] END max_depth=30, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time= 3.7s
[CV] END max_depth=30, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time= 1.2s
[CV] END max_depth=30, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=200; total time= 2.1s
[CV] END max_depth=30, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=300; total time= 3.4s
[CV] END max_depth=30, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=300; total time= 4.4s
[CV] END max_depth=30, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=100; total time= 1.2s
[CV] END max_depth=30, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=300; total time= 3.5s
[CV] END max_depth=30, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=300; total time= 3.9s
[CV] END max_depth=30, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time= 1.3s
[CV] END max_depth=30, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=300; total time= 3.4s
[CV] END max_depth=30, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=300; total time= 3.4s
[CV] END max_depth=30, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=200; total time= 2.2s
[CV] END bootstrap=False, max_depth=None, max_features=auto, min_samples_leaf=1,
min_samples_split=10, n_estimators=100; total time= 0.0s
[CV] END bootstrap=False, max_depth=None, max_features=auto, min_samples_leaf=1,
min_samples_split=10, n_estimators=100; total time= 0.0s
[CV] END bootstrap=False, max_depth=None, max_features=auto, min_samples_leaf=1,
min_samples_split=10, n_estimators=100; total time= 0.0s
[CV] END bootstrap=False, max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=500; total time= 6.5s
[CV] END bootstrap=False, max_depth=40, max_features=auto, min_samples_leaf=2,
min_samples_split=5, n_estimators=500; total time= 0.0s
[CV] END bootstrap=False, max_depth=40, max_features=auto, min_samples_leaf=2,
min_samples_split=5, n_estimators=500; total time= 0.0s
[CV] END bootstrap=False, max_depth=40, max_features=auto, min_samples_leaf=2,
min_samples_split=5, n_estimators=500; total time= 0.0s
[CV] END bootstrap=False, max_depth=40, max_features=auto, min_samples_leaf=2,
min_samples_split=10, n_estimators=200; total time= 0.0s
[CV] END bootstrap=False, max_depth=40, max_features=auto, min_samples_leaf=2,
min_samples_split=10, n_estimators=200; total time= 0.0s
[CV] END bootstrap=False, max_depth=40, max_features=auto, min_samples_leaf=2,
min_samples_split=10, n_estimators=200; total time= 0.0s
[CV] END bootstrap=False, max_depth=40, max_features=log2, min_samples_leaf=4,

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min_samples_split=2, n_estimators=500; total time= 8.7s
[CV] END bootstrap=False, max_depth=40, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=500; total time= 8.7s
[CV] END bootstrap=False, max_depth=30, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=100; total time= 1.9s
[CV] END bootstrap=True, max_depth=40, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=200; total time= 2.5s
[CV] END bootstrap=True, max_depth=40, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=100; total time= 1.1s
[CV] END bootstrap=False, max_depth=40, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=200; total time= 3.7s
[CV] END bootstrap=True, max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=200; total time= 2.2s
[CV] END bootstrap=True, max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=200; total time= 2.2s
[CV] END bootstrap=False, max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=200; total time= 3.9s
[CV] END bootstrap=False, max_depth=40, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=100; total time= 1.6s
[CV] END bootstrap=False, max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=300; total time= 3.9s
[CV] END bootstrap=True, max_depth=40, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=200; total time= 2.3s
[CV] END bootstrap=True, max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=500; total time= 4.5s
[CV] END bootstrap=False, max_depth=40, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time= 5.8s
[CV] END bootstrap=True, max_depth=40, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=200; total time= 2.3s
[CV] END bootstrap=True, max_depth=40, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=500; total time= 5.6s
[CV] END bootstrap=False, max_depth=40, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=300; total time= 5.9s
[CV] END bootstrap=False, max_depth=40, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=300; total time= 5.1s
[CV] END bootstrap=False, max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=500; total time= 8.3s
[CV] END bootstrap=False, max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=300; total time= 3.9s
[CV] END bootstrap=True, max_depth=10, max_features=auto, min_samples_leaf=4,
min_samples_split=10, n_estimators=200; total time= 0.0s
[CV] END bootstrap=True, max_depth=10, max_features=auto, min_samples_leaf=4,
min_samples_split=10, n_estimators=200; total time= 0.0s
[CV] END bootstrap=True, max_depth=10, max_features=auto, min_samples_leaf=4,
min_samples_split=10, n_estimators=200; total time= 0.0s
[CV] END bootstrap=True, max_depth=40, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=200; total time= 2.1s
[CV] END bootstrap=False, max_depth=40, max_features=sqrt, min_samples_leaf=4,

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min_samples_split=5, n_estimators=500; total time= 7.5s
[CV] END colsample_bytree=1.0, learning_rate=0.01, max_depth=7,
n_estimators=500, reg_alpha=1, reg_lambda=1, subsample=0.8; total time= 1.6s
[CV] END colsample_bytree=0.8, learning_rate=0.2, max_depth=5, n_estimators=200,
reg_alpha=0.1, reg_lambda=1.5, subsample=0.6; total time= 0.2s
[CV] END colsample_bytree=0.8, learning_rate=0.1, max_depth=10,
n_estimators=100, reg_alpha=0, reg_lambda=1.5, subsample=0.6; total time= 0.6s
[CV] END colsample_bytree=0.8, learning_rate=0.1, max_depth=10,
n_estimators=100, reg_alpha=0, reg_lambda=1.5, subsample=0.6; total time= 0.6s
[CV] END colsample_bytree=0.6, learning_rate=0.05, max_depth=10,
n_estimators=100, reg_alpha=0.1, reg_lambda=1.5, subsample=0.8; total time=
0.7s
[CV] END colsample_bytree=0.8, learning_rate=0.05, max_depth=7,
n_estimators=100, reg_alpha=0.1, reg_lambda=2, subsample=0.6; total time= 0.3s
[CV] END colsample_bytree=0.8, learning_rate=0.05, max_depth=7,
n_estimators=100, reg_alpha=0.1, reg_lambda=2, subsample=0.6; total time= 0.3s
[CV] END colsample_bytree=0.8, learning_rate=0.05, max_depth=7,
n_estimators=300, reg_alpha=0, reg_lambda=1.5, subsample=0.6; total time= 0.6s
[CV] END colsample_bytree=1.0, learning_rate=0.1, max_depth=7, n_estimators=100,
reg_alpha=1, reg_lambda=1, subsample=0.8; total time= 0.2s
[CV] END colsample_bytree=0.8, learning_rate=0.2, max_depth=10,
n_estimators=200, reg_alpha=0.1, reg_lambda=1, subsample=0.8; total time= 1.5s
[CV] END colsample_bytree=0.6, learning_rate=0.1, max_depth=7, n_estimators=100,
reg_alpha=0, reg_lambda=1, subsample=1.0; total time= 0.3s
[CV] END colsample_bytree=0.8, learning_rate=0.05, max_depth=10,
n_estimators=300, reg_alpha=1, reg_lambda=1, subsample=1.0; total time= 2.1s
[CV] END colsample_bytree=0.8, learning_rate=0.01, max_depth=5,
n_estimators=300, reg_alpha=0.1, reg_lambda=1, subsample=0.6; total time= 0.3s
[CV] END colsample_bytree=0.8, learning_rate=0.01, max_depth=5,
n_estimators=300, reg_alpha=0.1, reg_lambda=1, subsample=0.6; total time= 0.3s
[CV] END colsample_bytree=0.6, learning_rate=0.2, max_depth=7, n_estimators=100,
reg_alpha=0.1, reg_lambda=2, subsample=0.8; total time= 0.2s
[CV] END colsample_bytree=0.6, learning_rate=0.2, max_depth=7, n_estimators=100,
reg_alpha=0.1, reg_lambda=2, subsample=0.8; total time= 0.3s
[CV] END colsample_bytree=0.8, learning_rate=0.2, max_depth=5, n_estimators=300,
reg_alpha=0.1, reg_lambda=2, subsample=0.8; total time= 0.3s
[CV] END colsample_bytree=1.0, learning_rate=0.01, max_depth=3,
n_estimators=500, reg_alpha=1, reg_lambda=1, subsample=0.8; total time= 0.3s
[CV] END colsample_bytree=1.0, learning_rate=0.01, max_depth=3,
n_estimators=500, reg_alpha=1, reg_lambda=1, subsample=0.8; total time= 0.2s
[CV] END colsample_bytree=1.0, learning_rate=0.05, max_depth=3,
n_estimators=100, reg_alpha=0, reg_lambda=1, subsample=1.0; total time= 0.1s
[CV] END colsample_bytree=0.6, learning_rate=0.05, max_depth=5,
n_estimators=500, reg_alpha=1, reg_lambda=2, subsample=0.8; total time= 0.4s
[CV] END colsample_bytree=0.8, learning_rate=0.1, max_depth=7, n_estimators=300,
reg_alpha=1, reg_lambda=2, subsample=1.0; total time= 0.6s
[CV] END colsample_bytree=0.8, learning_rate=0.05, max_depth=5,
n_estimators=500, reg_alpha=0.1, reg_lambda=1.5, subsample=1.0; total time=

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0.5s

[CV] END colsample_bytree=0.8, learning_rate=0.01, max_depth=7,
n_estimators=500, reg_alpha=0.1, reg_lambda=2, subsample=0.8; total time= 1.1s
[CV] END colsample_bytree=0.6, learning_rate=0.05, max_depth=10,
n_estimators=500, reg_alpha=1, reg_lambda=1.5, subsample=1.0; total time= 3.0s
[CV] END colsample_bytree=0.6, learning_rate=0.2, max_depth=10,
n_estimators=300, reg_alpha=0.1, reg_lambda=1, subsample=1.0; total time= 1.7s
[CV] END colsample_bytree=1.0, learning_rate=0.2, max_depth=7, n_estimators=500,
reg_alpha=0, reg_lambda=1, subsample=1.0; total time= 1.2s
[CV] END colsample_bytree=1.0, learning_rate=0.2, max_depth=3, n_estimators=500,
reg_alpha=0.1, reg_lambda=1, subsample=0.8; total time= 0.2s
[CV] END colsample_bytree=0.8, learning_rate=0.1, max_depth=7, n_estimators=500,
reg_alpha=0.1, reg_lambda=2, subsample=0.6; total time= 1.2s
[CV] END colsample_bytree=0.8, learning_rate=0.1, max_depth=5, n_estimators=200,
reg_alpha=1, reg_lambda=1, subsample=1.0; total time= 0.2s
[CV] END colsample_bytree=0.8, learning_rate=0.1, max_depth=5, n_estimators=200,
reg_alpha=1, reg_lambda=1, subsample=1.0; total time= 0.2s
[CV] END colsample_bytree=0.6, learning_rate=0.1, max_depth=5, n_estimators=100,
reg_alpha=0, reg_lambda=1.5, subsample=0.6; total time= 0.1s
[CV] END colsample_bytree=0.8, learning_rate=0.01, max_depth=3,
n_estimators=300, reg_alpha=1, reg_lambda=2, subsample=0.6; total time= 0.2s
[CV] END colsample_bytree=0.6, learning_rate=0.01, max_depth=5,
n_estimators=500, reg_alpha=0, reg_lambda=1, subsample=0.6; total time= 0.6s
[CV] END colsample_bytree=0.8, learning_rate=0.1, max_depth=5, n_estimators=200,
reg_alpha=0, reg_lambda=2, subsample=0.8; total time= 0.2s
[CV] END colsample_bytree=1.0, learning_rate=0.1, max_depth=10,
n_estimators=100, reg_alpha=0.1, reg_lambda=1.5, subsample=1.0; total time=

0.6s

[CV] END colsample_bytree=0.8, learning_rate=0.01, max_depth=5,
n_estimators=300, reg_alpha=0.1, reg_lambda=1, subsample=0.6; total time= 0.3s
[CV] END colsample_bytree=0.6, learning_rate=0.2, max_depth=7, n_estimators=100,
reg_alpha=0.1, reg_lambda=2, subsample=0.8; total time= 0.2s
[CV] END colsample_bytree=0.8, learning_rate=0.2, max_depth=5, n_estimators=300,
reg_alpha=0.1, reg_lambda=2, subsample=0.8; total time= 0.3s
[CV] END colsample_bytree=0.8, learning_rate=0.2, max_depth=5, n_estimators=300,
reg_alpha=0.1, reg_lambda=2, subsample=0.8; total time= 0.3s
[CV] END colsample_bytree=1.0, learning_rate=0.01, max_depth=3,
n_estimators=500, reg_alpha=1, reg_lambda=1, subsample=0.8; total time= 0.3s
[CV] END colsample_bytree=1.0, learning_rate=0.05, max_depth=3,
n_estimators=100, reg_alpha=0, reg_lambda=1, subsample=1.0; total time= 0.1s
[CV] END colsample_bytree=1.0, learning_rate=0.05, max_depth=3,
n_estimators=100, reg_alpha=0, reg_lambda=1, subsample=1.0; total time= 0.1s
[CV] END colsample_bytree=1.0, learning_rate=0.05, max_depth=3,
n_estimators=100, reg_alpha=0, reg_lambda=1, subsample=1.0; total time= 0.1s
[CV] END colsample_bytree=0.6, learning_rate=0.05, max_depth=5,
n_estimators=500, reg_alpha=1, reg_lambda=2, subsample=0.8; total time= 0.4s
[CV] END colsample_bytree=0.8, learning_rate=0.1, max_depth=7, n_estimators=300,
reg_alpha=1, reg_lambda=2, subsample=1.0; total time= 0.6s

[CV] END colsample_bytree=0.8, learning_rate=0.01, max_depth=10,
 n_estimators=100, reg_alpha=0.1, reg_lambda=1, subsample=0.6; total time= 0.7s
 [CV] END colsample_bytree=0.8, learning_rate=0.1, max_depth=3, n_estimators=100,
 reg_alpha=1, reg_lambda=1, subsample=1.0; total time= 0.1s
 [CV] END colsample_bytree=0.6, learning_rate=0.2, max_depth=3, n_estimators=300,
 reg_alpha=0.1, reg_lambda=1.5, subsample=0.8; total time= 0.1s
 [CV] END colsample_bytree=0.6, learning_rate=0.2, max_depth=5, n_estimators=300,
 reg_alpha=1, reg_lambda=1, subsample=1.0; total time= 0.3s
 [CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
 min_samples_split=10, n_estimators=100; total time= 1.1s
 [CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
 min_samples_split=10, n_estimators=200; total time= 2.4s
 [CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
 min_samples_split=10, n_estimators=200; total time= 2.3s
 [CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
 min_samples_split=10, n_estimators=200; total time= 2.5s
 [CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
 min_samples_split=10, n_estimators=200; total time= 2.3s
 [CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
 min_samples_split=10, n_estimators=200; total time= 2.3s
 [CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
 min_samples_split=10, n_estimators=300; total time= 3.6s
 [CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
 min_samples_split=10, n_estimators=300; total time= 3.5s
 [CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
 min_samples_split=10, n_estimators=300; total time= 3.8s
 [CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
 min_samples_split=2, n_estimators=100; total time= 1.4s
 [CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
 min_samples_split=2, n_estimators=100; total time= 1.4s
 [CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
 min_samples_split=2, n_estimators=100; total time= 1.3s
 [CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
 min_samples_split=10, n_estimators=300; total time= 3.6s
 [CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
 min_samples_split=10, n_estimators=300; total time= 3.4s
 [CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
 min_samples_split=10, n_estimators=300; total time= 3.4s
 [CV] END max_depth=10, max_features=auto, min_samples_leaf=1,
 min_samples_split=2, n_estimators=100; total time= 0.0s
 [CV] END max_depth=10, max_features=auto, min_samples_leaf=1,
 min_samples_split=2, n_estimators=100; total time= 0.0s
 [CV] END max_depth=10, max_features=auto, min_samples_leaf=1,
 min_samples_split=2, n_estimators=100; total time= 0.0s
 [CV] END max_depth=10, max_features=auto, min_samples_leaf=1,
 min_samples_split=2, n_estimators=200; total time= 0.0s
 [CV] END max_depth=10, max_features=auto, min_samples_leaf=1,
 min_samples_split=2, n_estimators=200; total time= 0.0s

[CV] END max_depth=30, max_features=sqrt, min_samples_leaf=2,
 min_samples_split=2, n_estimators=100; total time= 1.4s
 [CV] END max_depth=30, max_features=sqrt, min_samples_leaf=2,
 min_samples_split=2, n_estimators=100; total time= 1.3s
 [CV] END max_depth=30, max_features=sqrt, min_samples_leaf=2,
 min_samples_split=10, n_estimators=100; total time= 1.2s
 [CV] END max_depth=30, max_features=sqrt, min_samples_leaf=2,
 min_samples_split=10, n_estimators=100; total time= 1.1s
 [CV] END max_depth=30, max_features=sqrt, min_samples_leaf=2,
 min_samples_split=10, n_estimators=200; total time= 2.3s
 [CV] END max_depth=30, max_features=sqrt, min_samples_leaf=2,
 min_samples_split=10, n_estimators=200; total time= 2.3s
 [CV] END max_depth=30, max_features=sqrt, min_samples_leaf=4,
 min_samples_split=5, n_estimators=300; total time= 3.3s
 [CV] END max_depth=30, max_features=sqrt, min_samples_leaf=4,
 min_samples_split=10, n_estimators=200; total time= 2.1s
 [CV] END max_depth=30, max_features=log2, min_samples_leaf=1,
 min_samples_split=2, n_estimators=100; total time= 1.6s
 [CV] END max_depth=30, max_features=log2, min_samples_leaf=1,
 min_samples_split=2, n_estimators=200; total time= 3.0s
 [CV] END max_depth=30, max_features=log2, min_samples_leaf=1,
 min_samples_split=5, n_estimators=200; total time= 2.6s
 [CV] END max_depth=30, max_features=log2, min_samples_leaf=1,
 min_samples_split=10, n_estimators=200; total time= 2.3s
 [CV] END max_depth=30, max_features=log2, min_samples_leaf=2,
 min_samples_split=2, n_estimators=100; total time= 1.3s
 [CV] END max_depth=30, max_features=log2, min_samples_leaf=2,
 min_samples_split=2, n_estimators=200; total time= 2.6s
 [CV] END max_depth=30, max_features=log2, min_samples_leaf=2,
 min_samples_split=5, n_estimators=200; total time= 2.5s
 [CV] END max_depth=30, max_features=log2, min_samples_leaf=2,
 min_samples_split=10, n_estimators=200; total time= 2.4s
 [CV] END max_depth=30, max_features=log2, min_samples_leaf=4,
 min_samples_split=2, n_estimators=100; total time= 1.1s
 [CV] END max_depth=30, max_features=log2, min_samples_leaf=4,
 min_samples_split=2, n_estimators=300; total time= 3.3s
 [CV] END max_depth=30, max_features=log2, min_samples_leaf=4,
 min_samples_split=10, n_estimators=100; total time= 1.1s
 [CV] END max_depth=30, max_features=log2, min_samples_leaf=4,
 min_samples_split=10, n_estimators=200; total time= 2.2s
 [CV] END bootstrap=False, max_depth=10, max_features=log2, min_samples_leaf=1,
 min_samples_split=10, n_estimators=500; total time= 6.6s
 [CV] END bootstrap=False, max_depth=40, max_features=log2, min_samples_leaf=4,
 min_samples_split=2, n_estimators=500; total time= 8.8s
 [CV] END bootstrap=False, max_depth=30, max_features=sqrt, min_samples_leaf=2,
 min_samples_split=10, n_estimators=500; total time= 8.9s
 [CV] END bootstrap=False, max_depth=30, max_features=auto, min_samples_leaf=4,
 min_samples_split=5, n_estimators=200; total time= 0.0s

[CV] END bootstrap=False, max_depth=30, max_features=auto, min_samples_leaf=4, min_samples_split=5, n_estimators=200; total time= 0.0s

[CV] END bootstrap=False, max_depth=30, max_features=auto, min_samples_leaf=4, min_samples_split=5, n_estimators=200; total time= 0.0s

[CV] END bootstrap=True, max_depth=None, max_features=sqrt, min_samples_leaf=2, min_samples_split=10, n_estimators=100; total time= 1.1s

[CV] END bootstrap=True, max_depth=None, max_features=sqrt, min_samples_leaf=4, min_samples_split=10, n_estimators=300; total time= 3.2s

[CV] END bootstrap=False, max_depth=40, max_features=auto, min_samples_leaf=2, min_samples_split=2, n_estimators=500; total time= 0.0s

[CV] END bootstrap=False, max_depth=40, max_features=auto, min_samples_leaf=2, min_samples_split=2, n_estimators=500; total time= 0.0s

[CV] END bootstrap=False, max_depth=40, max_features=auto, min_samples_leaf=2, min_samples_split=2, n_estimators=500; total time= 0.0s

[CV] END bootstrap=False, max_depth=20, max_features=log2, min_samples_leaf=1, min_samples_split=10, n_estimators=200; total time= 3.7s

[CV] END bootstrap=False, max_depth=40, max_features=sqrt, min_samples_leaf=2, min_samples_split=10, n_estimators=200; total time= 3.4s

[CV] END bootstrap=True, max_depth=10, max_features=sqrt, min_samples_leaf=4, min_samples_split=5, n_estimators=300; total time= 2.7s

[CV] END bootstrap=True, max_depth=None, max_features=log2, min_samples_leaf=2, min_samples_split=2, n_estimators=300; total time= 3.8s

[CV] END bootstrap=True, max_depth=30, max_features=sqrt, min_samples_leaf=4, min_samples_split=5, n_estimators=200; total time= 2.2s

[CV] END bootstrap=True, max_depth=None, max_features=log2, min_samples_leaf=2, min_samples_split=5, n_estimators=100; total time= 1.3s

[CV] END bootstrap=True, max_depth=None, max_features=auto, min_samples_leaf=4, min_samples_split=5, n_estimators=500; total time= 0.0s

[CV] END bootstrap=True, max_depth=None, max_features=auto, min_samples_leaf=4, min_samples_split=5, n_estimators=500; total time= 0.0s

[CV] END bootstrap=True, max_depth=None, max_features=auto, min_samples_leaf=4, min_samples_split=5, n_estimators=500; total time= 0.0s

[CV] END bootstrap=False, max_depth=20, max_features=auto, min_samples_leaf=4, min_samples_split=5, n_estimators=500; total time= 0.0s

[CV] END bootstrap=False, max_depth=20, max_features=auto, min_samples_leaf=4, min_samples_split=5, n_estimators=500; total time= 0.0s

[CV] END bootstrap=False, max_depth=20, max_features=auto, min_samples_leaf=4, min_samples_split=5, n_estimators=500; total time= 0.0s

[CV] END bootstrap=False, max_depth=None, max_features=auto, min_samples_leaf=1, min_samples_split=2, n_estimators=500; total time= 0.0s

[CV] END bootstrap=False, max_depth=None, max_features=auto, min_samples_leaf=1, min_samples_split=2, n_estimators=500; total time= 0.0s

[CV] END bootstrap=False, max_depth=None, max_features=auto, min_samples_leaf=1, min_samples_split=2, n_estimators=500; total time= 0.0s

[CV] END bootstrap=True, max_depth=10, max_features=log2, min_samples_leaf=2, min_samples_split=2, n_estimators=100; total time= 1.0s

[CV] END bootstrap=True, max_depth=40, max_features=sqrt, min_samples_leaf=4, min_samples_split=2, n_estimators=200; total time= 2.3s

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[CV] END bootstrap=True, max_depth=30, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=200; total time= 2.3s
[CV] END bootstrap=False, max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=100; total time= 1.9s
[CV] END bootstrap=False, max_depth=30, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=200; total time= 3.2s
[CV] END bootstrap=False, max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=300; total time= 5.0s
[CV] END bootstrap=True, max_depth=40, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=200; total time= 2.4s
[CV] END bootstrap=False, max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=200; total time= 3.4s
[CV] END bootstrap=False, max_depth=None, max_features=auto, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time= 0.0s
[CV] END bootstrap=False, max_depth=None, max_features=auto, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time= 0.0s
[CV] END bootstrap=False, max_depth=None, max_features=auto, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time= 0.0s
[CV] END bootstrap=False, max_depth=40, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=300; total time= 6.0s
[CV] END bootstrap=False, max_depth=30, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=200; total time= 3.9s
[CV] END bootstrap=True, max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 1.3s
[CV] END bootstrap=False, max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=500; total time= 8.4s
[CV] END bootstrap=True, max_depth=30, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=100; total time= 1.2s
[CV] END bootstrap=True, max_depth=30, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=100; total time= 1.1s
[CV] END bootstrap=True, max_depth=30, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=100; total time= 1.2s
[CV] END bootstrap=False, max_depth=30, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 2.0s
[CV] END bootstrap=False, max_depth=40, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=500; total time= 7.6s
[CV] END colsample_bytree=1.0, learning_rate=0.01, max_depth=7,
n_estimators=500, reg_alpha=1, reg_lambda=1, subsample=0.8; total time= 1.6s
[CV] END colsample_bytree=0.8, learning_rate=0.2, max_depth=10,
n_estimators=500, reg_alpha=0.1, reg_lambda=2, subsample=0.6; total time= 3.1s
[CV] END colsample_bytree=1.0, learning_rate=0.2, max_depth=7, n_estimators=500,
reg_alpha=0, reg_lambda=1, subsample=1.0; total time= 1.2s
[CV] END colsample_bytree=1.0, learning_rate=0.05, max_depth=7,
n_estimators=100, reg_alpha=0.1, reg_lambda=1.5, subsample=0.8; total time=
0.3s
[CV] END colsample_bytree=0.6, learning_rate=0.05, max_depth=3,
n_estimators=200, reg_alpha=0.1, reg_lambda=2, subsample=0.6; total time= 0.1s
[CV] END colsample_bytree=0.6, learning_rate=0.05, max_depth=3,

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n_estimators=200, reg_alpha=0.1, reg_lambda=2, subsample=0.6; total time= 0.1s
[CV] END colsample_bytree=0.6, learning_rate=0.1, max_depth=7, n_estimators=100,
reg_alpha=0, reg_lambda=1, subsample=1.0; total time= 0.2s
[CV] END colsample_bytree=0.8, learning_rate=0.05, max_depth=10,
n_estimators=300, reg_alpha=1, reg_lambda=1, subsample=1.0; total time= 2.2s
[CV] END colsample_bytree=0.8, learning_rate=0.01, max_depth=5,
n_estimators=300, reg_alpha=0.1, reg_lambda=1, subsample=0.6; total time= 0.3s
[CV] END colsample_bytree=0.6, learning_rate=0.1, max_depth=10,
n_estimators=300, reg_alpha=1, reg_lambda=2, subsample=0.8; total time= 1.7s
[CV] END colsample_bytree=0.6, learning_rate=0.05, max_depth=5,
n_estimators=500, reg_alpha=1, reg_lambda=2, subsample=0.8; total time= 0.5s
[CV] END colsample_bytree=0.8, learning_rate=0.05, max_depth=7,
n_estimators=300, reg_alpha=0, reg_lambda=1.5, subsample=1.0; total time= 0.7s
[CV] END colsample_bytree=0.8, learning_rate=0.05, max_depth=5,
n_estimators=500, reg_alpha=0.1, reg_lambda=1.5, subsample=1.0; total time=
0.4s
[CV] END colsample_bytree=0.8, learning_rate=0.01, max_depth=7,
n_estimators=500, reg_alpha=0.1, reg_lambda=2, subsample=0.8; total time= 1.2s
[CV] END colsample_bytree=1.0, learning_rate=0.01, max_depth=7,
n_estimators=500, reg_alpha=1, reg_lambda=1, subsample=0.8; total time= 1.6s
[CV] END colsample_bytree=0.8, learning_rate=0.2, max_depth=5, n_estimators=200,
reg_alpha=0.1, reg_lambda=1.5, subsample=0.6; total time= 0.2s
[CV] END colsample_bytree=0.8, learning_rate=0.2, max_depth=5, n_estimators=200,
reg_alpha=0.1, reg_lambda=1.5, subsample=0.6; total time= 0.2s
[CV] END colsample_bytree=0.8, learning_rate=0.1, max_depth=10,
n_estimators=100, reg_alpha=0, reg_lambda=1.5, subsample=0.6; total time= 0.7s
[CV] END colsample_bytree=0.6, learning_rate=0.01, max_depth=5,
n_estimators=100, reg_alpha=1, reg_lambda=1.5, subsample=0.8; total time= 0.1s
[CV] END colsample_bytree=0.6, learning_rate=0.01, max_depth=5,
n_estimators=100, reg_alpha=1, reg_lambda=1.5, subsample=0.8; total time= 0.1s
[CV] END colsample_bytree=0.6, learning_rate=0.2, max_depth=10,
n_estimators=300, reg_alpha=0.1, reg_lambda=1, subsample=1.0; total time= 1.9s
[CV] END colsample_bytree=0.6, learning_rate=0.1, max_depth=7, n_estimators=500,
reg_alpha=1, reg_lambda=1.5, subsample=1.0; total time= 1.0s
[CV] END colsample_bytree=1.0, learning_rate=0.05, max_depth=7,
n_estimators=100, reg_alpha=0.1, reg_lambda=1.5, subsample=0.8; total time=
0.3s
[CV] END colsample_bytree=0.8, learning_rate=0.1, max_depth=7, n_estimators=500,
reg_alpha=0.1, reg_lambda=2, subsample=0.6; total time= 1.1s
[CV] END colsample_bytree=0.8, learning_rate=0.01, max_depth=7,
n_estimators=500, reg_alpha=1, reg_lambda=1.5, subsample=0.8; total time= 1.3s
[CV] END colsample_bytree=0.8, learning_rate=0.1, max_depth=5, n_estimators=200,
reg_alpha=0, reg_lambda=2, subsample=0.8; total time= 0.2s
[CV] END colsample_bytree=0.8, learning_rate=0.1, max_depth=10,
n_estimators=500, reg_alpha=0, reg_lambda=2, subsample=1.0; total time= 3.1s
[CV] END colsample_bytree=0.6, learning_rate=0.05, max_depth=5,
n_estimators=300, reg_alpha=0, reg_lambda=2, subsample=0.6; total time= 0.3s
[CV] END colsample_bytree=0.8, learning_rate=0.05, max_depth=5,

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n_estimators=500, reg_alpha=0.1, reg_lambda=1.5, subsample=1.0; total time=
0.5s
[CV] END colsample_bytree=0.8, learning_rate=0.01, max_depth=7,
n_estimators=500, reg_alpha=0.1, reg_lambda=2, subsample=0.8; total time= 1.1s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=300; total time= 3.4s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=300; total time= 3.2s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=100; total time= 1.5s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=100; total time= 1.5s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=100; total time= 1.5s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=200; total time= 3.0s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=200; total time= 3.1s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=200; total time= 3.1s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=300; total time= 3.6s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=100; total time= 1.2s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=100; total time= 1.1s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=100; total time= 1.1s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=200; total time= 2.3s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=200; total time= 2.2s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=200; total time= 2.5s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=300; total time= 3.4s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=200; total time= 1.9s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=300; total time= 2.7s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=300; total time= 2.7s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=300; total time= 2.8s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=100; total time= 0.9s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=200; total time= 1.8s

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[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
 min_samples_split=2, n_estimators=100; total time= 0.9s
 [CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
 min_samples_split=2, n_estimators=200; total time= 1.8s
 [CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
 min_samples_split=5, n_estimators=200; total time= 1.8s
 [CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
 min_samples_split=10, n_estimators=100; total time= 0.9s
 [CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
 min_samples_split=10, n_estimators=300; total time= 2.7s
 [CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
 min_samples_split=5, n_estimators=100; total time= 1.0s
 [CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
 min_samples_split=5, n_estimators=200; total time= 1.8s
 [CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
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 [CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
 min_samples_split=2, n_estimators=100; total time= 0.9s
 [CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
 min_samples_split=2, n_estimators=300; total time= 2.7s
 [CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
 min_samples_split=10, n_estimators=100; total time= 0.8s
 [CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
 min_samples_split=10, n_estimators=200; total time= 1.8s
 [CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
 min_samples_split=5, n_estimators=100; total time= 1.3s
 [CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
 min_samples_split=5, n_estimators=100; total time= 1.3s
 [CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
 min_samples_split=5, n_estimators=100; total time= 1.3s
 [CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
 min_samples_split=5, n_estimators=200; total time= 2.6s
 [CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
 min_samples_split=2, n_estimators=300; total time= 3.9s
 [CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
 min_samples_split=2, n_estimators=300; total time= 4.0s
 [CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
 min_samples_split=2, n_estimators=300; total time= 3.9s
 [CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
 min_samples_split=5, n_estimators=100; total time= 1.3s
 [CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
 min_samples_split=5, n_estimators=300; total time= 3.9s
 [CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
 min_samples_split=5, n_estimators=300; total time= 4.1s
 [CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
 min_samples_split=10, n_estimators=100; total time= 1.3s
 [CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
 min_samples_split=10, n_estimators=100; total time= 1.2s

[CV] END max_depth=30, max_features=log2, min_samples_leaf=2,
 min_samples_split=5, n_estimators=100; total time= 1.3s
 [CV] END max_depth=30, max_features=log2, min_samples_leaf=2,
 min_samples_split=5, n_estimators=200; total time= 2.5s
 [CV] END max_depth=30, max_features=log2, min_samples_leaf=2,
 min_samples_split=10, n_estimators=100; total time= 1.2s
 [CV] END max_depth=30, max_features=log2, min_samples_leaf=2,
 min_samples_split=10, n_estimators=300; total time= 3.5s
 [CV] END max_depth=30, max_features=log2, min_samples_leaf=4,
 min_samples_split=5, n_estimators=100; total time= 1.1s
 [CV] END max_depth=30, max_features=log2, min_samples_leaf=4,
 min_samples_split=5, n_estimators=200; total time= 2.2s
 [CV] END max_depth=30, max_features=log2, min_samples_leaf=4,
 min_samples_split=10, n_estimators=200; total time= 2.2s
 [CV] END bootstrap=False, max_depth=10, max_features=log2, min_samples_leaf=1,
 min_samples_split=10, n_estimators=500; total time= 6.6s
 [CV] END bootstrap=False, max_depth=30, max_features=sqrt, min_samples_leaf=2,
 min_samples_split=10, n_estimators=500; total time= 8.9s
 [CV] END bootstrap=False, max_depth=30, max_features=sqrt, min_samples_leaf=2,
 min_samples_split=10, n_estimators=500; total time= 8.9s
 [CV] END bootstrap=True, max_depth=None, max_features=sqrt, min_samples_leaf=2,
 min_samples_split=10, n_estimators=100; total time= 1.1s
 [CV] END bootstrap=True, max_depth=None, max_features=sqrt, min_samples_leaf=4,
 min_samples_split=10, n_estimators=300; total time= 3.2s
 [CV] END bootstrap=False, max_depth=20, max_features=log2, min_samples_leaf=1,
 min_samples_split=10, n_estimators=200; total time= 3.7s
 [CV] END bootstrap=False, max_depth=20, max_features=auto, min_samples_leaf=1,
 min_samples_split=5, n_estimators=100; total time= 0.0s
 [CV] END bootstrap=False, max_depth=20, max_features=auto, min_samples_leaf=1,
 min_samples_split=5, n_estimators=100; total time= 0.0s
 [CV] END bootstrap=False, max_depth=20, max_features=auto, min_samples_leaf=1,
 min_samples_split=5, n_estimators=100; total time= 0.0s
 [CV] END bootstrap=False, max_depth=10, max_features=auto, min_samples_leaf=1,
 min_samples_split=10, n_estimators=100; total time= 0.0s
 [CV] END bootstrap=False, max_depth=10, max_features=auto, min_samples_leaf=1,
 min_samples_split=10, n_estimators=100; total time= 0.0s
 [CV] END bootstrap=False, max_depth=10, max_features=auto, min_samples_leaf=1,
 min_samples_split=10, n_estimators=100; total time= 0.0s
 [CV] END bootstrap=False, max_depth=10, max_features=auto, min_samples_leaf=4,
 min_samples_split=5, n_estimators=500; total time= 0.0s
 [CV] END bootstrap=False, max_depth=10, max_features=auto, min_samples_leaf=4,
 min_samples_split=5, n_estimators=500; total time= 0.0s
 [CV] END bootstrap=False, max_depth=10, max_features=auto, min_samples_leaf=4,
 min_samples_split=5, n_estimators=500; total time= 0.0s
 [CV] END bootstrap=True, max_depth=None, max_features=sqrt, min_samples_leaf=2,
 min_samples_split=2, n_estimators=500; total time= 6.4s
 [CV] END bootstrap=True, max_depth=None, max_features=log2, min_samples_leaf=2,
 min_samples_split=2, n_estimators=300; total time= 3.8s

[CV] END bootstrap=False, max_depth=10, max_features=sqrt, min_samples_leaf=2, min_samples_split=10, n_estimators=300; total time= 3.9s

[CV] END bootstrap=True, max_depth=10, max_features=log2, min_samples_leaf=2, min_samples_split=2, n_estimators=100; total time= 1.0s

[CV] END bootstrap=True, max_depth=30, max_features=sqrt, min_samples_leaf=2, min_samples_split=10, n_estimators=200; total time= 2.3s

[CV] END bootstrap=False, max_depth=20, max_features=log2, min_samples_leaf=2, min_samples_split=5, n_estimators=100; total time= 1.9s

[CV] END bootstrap=False, max_depth=20, max_features=log2, min_samples_leaf=2, min_samples_split=5, n_estimators=100; total time= 1.9s

[CV] END bootstrap=False, max_depth=40, max_features=log2, min_samples_leaf=2, min_samples_split=5, n_estimators=300; total time= 5.6s

[CV] END bootstrap=False, max_depth=30, max_features=auto, min_samples_leaf=2, min_samples_split=2, n_estimators=100; total time= 0.0s

[CV] END bootstrap=False, max_depth=30, max_features=auto, min_samples_leaf=2, min_samples_split=2, n_estimators=100; total time= 0.0s

[CV] END bootstrap=False, max_depth=30, max_features=auto, min_samples_leaf=2, min_samples_split=2, n_estimators=100; total time= 0.0s

[CV] END bootstrap=True, max_depth=40, max_features=sqrt, min_samples_leaf=1, min_samples_split=10, n_estimators=200; total time= 2.4s

[CV] END bootstrap=True, max_depth=40, max_features=log2, min_samples_leaf=4, min_samples_split=2, n_estimators=500; total time= 5.6s

[CV] END bootstrap=False, max_depth=40, max_features=sqrt, min_samples_leaf=1, min_samples_split=5, n_estimators=300; total time= 6.0s

[CV] END bootstrap=False, max_depth=30, max_features=log2, min_samples_leaf=2, min_samples_split=2, n_estimators=200; total time= 3.9s

[CV] END bootstrap=True, max_depth=20, max_features=sqrt, min_samples_leaf=1, min_samples_split=5, n_estimators=100; total time= 1.3s

[CV] END bootstrap=True, max_depth=None, max_features=log2, min_samples_leaf=4, min_samples_split=10, n_estimators=500; total time= 5.5s

[CV] END bootstrap=True, max_depth=None, max_features=sqrt, min_samples_leaf=2, min_samples_split=10, n_estimators=500; total time= 5.8s

[CV] END bootstrap=False, max_depth=40, max_features=log2, min_samples_leaf=4, min_samples_split=2, n_estimators=200; total time= 3.4s

[CV] END bootstrap=True, max_depth=10, max_features=sqrt, min_samples_leaf=4, min_samples_split=10, n_estimators=300; total time= 2.7s

[CV] END colsample_bytree=0.6, learning_rate=0.05, max_depth=10, n_estimators=500, reg_alpha=1, reg_lambda=1.5, subsample=1.0; total time= 3.0s

[CV] END colsample_bytree=0.6, learning_rate=0.2, max_depth=10, n_estimators=300, reg_alpha=0.1, reg_lambda=1, subsample=1.0; total time= 1.8s

[CV] END colsample_bytree=0.6, learning_rate=0.1, max_depth=7, n_estimators=500, reg_alpha=1, reg_lambda=1.5, subsample=1.0; total time= 1.2s

[CV] END colsample_bytree=1.0, learning_rate=0.2, max_depth=3, n_estimators=500, reg_alpha=0.1, reg_lambda=1, subsample=0.8; total time= 0.3s

[CV] END colsample_bytree=0.8, learning_rate=0.1, max_depth=7, n_estimators=500, reg_alpha=0.1, reg_lambda=2, subsample=0.6; total time= 1.2s

[CV] END colsample_bytree=0.8, learning_rate=0.1, max_depth=5, n_estimators=200, reg_alpha=1, reg_lambda=1, subsample=1.0; total time= 0.2s

[CV] END colsample_bytree=0.6, learning_rate=0.1, max_depth=5, n_estimators=100, reg_alpha=0, reg_lambda=1.5, subsample=0.6; total time= 0.1s

[CV] END colsample_bytree=0.6, learning_rate=0.1, max_depth=5, n_estimators=100, reg_alpha=0, reg_lambda=1.5, subsample=0.6; total time= 0.1s

[CV] END colsample_bytree=0.8, learning_rate=0.01, max_depth=3, n_estimators=300, reg_alpha=1, reg_lambda=2, subsample=0.6; total time= 0.2s

[CV] END colsample_bytree=0.8, learning_rate=0.01, max_depth=3, n_estimators=300, reg_alpha=1, reg_lambda=2, subsample=0.6; total time= 0.2s

[CV] END colsample_bytree=0.6, learning_rate=0.01, max_depth=5, n_estimators=500, reg_alpha=0, reg_lambda=1, subsample=0.6; total time= 0.5s

[CV] END colsample_bytree=0.8, learning_rate=0.1, max_depth=10, n_estimators=500, reg_alpha=0, reg_lambda=2, subsample=1.0; total time= 3.3s

[CV] END colsample_bytree=0.6, learning_rate=0.05, max_depth=5, n_estimators=300, reg_alpha=0, reg_lambda=2, subsample=0.6; total time= 0.3s

[CV] END colsample_bytree=0.6, learning_rate=0.01, max_depth=7, n_estimators=100, reg_alpha=1, reg_lambda=2, subsample=0.8; total time= 0.2s

[CV] END colsample_bytree=0.8, learning_rate=0.01, max_depth=7, n_estimators=500, reg_alpha=0.1, reg_lambda=2, subsample=0.8; total time= 1.2s

[CV] END colsample_bytree=1.0, learning_rate=0.01, max_depth=7, n_estimators=500, reg_alpha=1, reg_lambda=1, subsample=0.8; total time= 1.6s

[CV] END colsample_bytree=0.8, learning_rate=0.2, max_depth=5, n_estimators=200, reg_alpha=0.1, reg_lambda=1.5, subsample=0.6; total time= 0.2s

[CV] END colsample_bytree=0.8, learning_rate=0.1, max_depth=10, n_estimators=100, reg_alpha=0, reg_lambda=1.5, subsample=0.6; total time= 0.8s

[CV] END colsample_bytree=0.8, learning_rate=0.1, max_depth=10, n_estimators=100, reg_alpha=0, reg_lambda=1.5, subsample=0.6; total time= 0.7s

[CV] END colsample_bytree=0.6, learning_rate=0.05, max_depth=10, n_estimators=100, reg_alpha=0.1, reg_lambda=1.5, subsample=0.8; total time= 0.7s

[CV] END colsample_bytree=0.8, learning_rate=0.05, max_depth=7, n_estimators=100, reg_alpha=0.1, reg_lambda=2, subsample=0.6; total time= 0.3s

[CV] END colsample_bytree=0.8, learning_rate=0.05, max_depth=7, n_estimators=300, reg_alpha=0, reg_lambda=1.5, subsample=0.6; total time= 0.7s

[CV] END colsample_bytree=1.0, learning_rate=0.1, max_depth=7, n_estimators=100, reg_alpha=1, reg_lambda=1, subsample=0.8; total time= 0.3s

[CV] END colsample_bytree=0.8, learning_rate=0.2, max_depth=10, n_estimators=200, reg_alpha=0.1, reg_lambda=1, subsample=0.8; total time= 1.6s

[CV] END colsample_bytree=0.8, learning_rate=0.05, max_depth=10, n_estimators=300, reg_alpha=1, reg_lambda=1, subsample=1.0; total time= 2.4s

[CV] END colsample_bytree=0.8, learning_rate=0.01, max_depth=5, n_estimators=300, reg_alpha=0.1, reg_lambda=1, subsample=0.6; total time= 0.4s

[CV] END colsample_bytree=0.6, learning_rate=0.1, max_depth=10, n_estimators=300, reg_alpha=1, reg_lambda=2, subsample=0.8; total time= 1.7s

[CV] END colsample_bytree=0.8, learning_rate=0.1, max_depth=7, n_estimators=300, reg_alpha=1, reg_lambda=2, subsample=1.0; total time= 0.7s

[CV] END colsample_bytree=0.6, learning_rate=0.05, max_depth=5, n_estimators=300, reg_alpha=0, reg_lambda=2, subsample=0.6; total time= 0.3s

[CV] END colsample_bytree=0.6, learning_rate=0.01, max_depth=7,

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n_estimators=100, reg_alpha=1, reg_lambda=2, subsample=0.8; total time=    0.3s
[CV] END colsample_bytree=0.8, learning_rate=0.01, max_depth=7,
n_estimators=500, reg_alpha=0.1, reg_lambda=2, subsample=0.8; total time=    1.2s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=100; total time=    1.4s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=100; total time=    1.5s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=100; total time=    1.4s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=200; total time=    2.9s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=200; total time=    3.1s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=200; total time=    3.1s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=300; total time=    4.4s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=300; total time=    4.3s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=300; total time=    3.3s
[CV] END max_depth=30, max_features=auto, min_samples_leaf=1,
min_samples_split=2, n_estimators=100; total time=    0.0s
[CV] END max_depth=30, max_features=auto, min_samples_leaf=1,
min_samples_split=2, n_estimators=100; total time=    0.0s
[CV] END max_depth=30, max_features=auto, min_samples_leaf=1,
min_samples_split=2, n_estimators=100; total time=    0.0s
[CV] END max_depth=30, max_features=auto, min_samples_leaf=1,
min_samples_split=2, n_estimators=200; total time=    0.0s
[CV] END max_depth=30, max_features=auto, min_samples_leaf=1,
min_samples_split=2, n_estimators=200; total time=    0.0s
[CV] END max_depth=30, max_features=auto, min_samples_leaf=1,
min_samples_split=2, n_estimators=200; total time=    0.0s
[CV] END max_depth=30, max_features=auto, min_samples_leaf=1,
min_samples_split=2, n_estimators=200; total time=    0.0s
[CV] END max_depth=30, max_features=auto, min_samples_leaf=1,
min_samples_split=2, n_estimators=300; total time=    0.0s
[CV] END max_depth=30, max_features=auto, min_samples_leaf=1,
min_samples_split=2, n_estimators=300; total time=    0.0s
[CV] END max_depth=30, max_features=auto, min_samples_leaf=1,
min_samples_split=2, n_estimators=300; total time=    0.0s
[CV] END max_depth=30, max_features=auto, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time=    0.0s
[CV] END max_depth=30, max_features=auto, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time=    0.0s
[CV] END max_depth=30, max_features=auto, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time=    0.0s
[CV] END max_depth=30, max_features=auto, min_samples_leaf=1,
min_samples_split=5, n_estimators=200; total time=    0.0s
[CV] END max_depth=30, max_features=auto, min_samples_leaf=1,

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[illegible]

[illegible]

[illegible]

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min_samples_split=10, n_estimators=100; total time= 1.2s
[CV] END max_depth=30, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=100; total time= 1.2s
[CV] END max_depth=30, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=200; total time= 2.3s
[CV] END max_depth=30, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=100; total time= 1.3s
[CV] END max_depth=30, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=200; total time= 2.5s
[CV] END max_depth=30, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=200; total time= 2.6s
[CV] END max_depth=30, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=200; total time= 2.5s
[CV] END max_depth=30, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=200; total time= 2.2s
[CV] END max_depth=30, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=200; total time= 2.2s
[CV] END max_depth=30, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=200; total time= 2.2s
[CV] END max_depth=30, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=300; total time= 3.4s
[CV] END max_depth=30, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 1.3s
[CV] END max_depth=30, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 1.4s
[CV] END max_depth=30, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=300; total time= 3.9s
[CV] END max_depth=30, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=100; total time= 1.3s
[CV] END max_depth=30, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=200; total time= 2.6s
[CV] END max_depth=30, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=200; total time= 2.5s
[CV] END max_depth=30, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=200; total time= 2.4s
[CV] END max_depth=30, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=100; total time= 1.0s
[CV] END max_depth=30, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=300; total time= 3.3s
[CV] END max_depth=30, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=300; total time= 3.3s
[CV] END bootstrap=False, max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=100; total time= 2.0s
[CV] END bootstrap=False, max_depth=40, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=500; total time= 10.0s
[CV] END bootstrap=False, max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=300; total time= 5.6s
[CV] END bootstrap=False, max_depth=None, max_features=log2, min_samples_leaf=2,

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min_samples_split=10, n_estimators=300; total time= 5.3s
[CV] END bootstrap=False, max_depth=30, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=100; total time= 1.9s
[CV] END bootstrap=True, max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=300; total time= 3.3s
[CV] END bootstrap=True, max_depth=40, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=100; total time= 1.1s
[CV] END bootstrap=False, max_depth=40, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=200; total time= 3.7s
[CV] END bootstrap=True, max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=500; total time= 6.4s
[CV] END bootstrap=True, max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=200; total time= 2.2s
[CV] END bootstrap=False, max_depth=40, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=100; total time= 1.7s
[CV] END bootstrap=False, max_depth=10, max_features=auto, min_samples_leaf=4,
min_samples_split=5, n_estimators=200; total time= 0.0s
[CV] END bootstrap=False, max_depth=10, max_features=auto, min_samples_leaf=4,
min_samples_split=5, n_estimators=200; total time= 0.0s
[CV] END bootstrap=False, max_depth=10, max_features=auto, min_samples_leaf=4,
min_samples_split=5, n_estimators=200; total time= 0.0s
[CV] END bootstrap=False, max_depth=30, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time= 6.0s
[CV] END bootstrap=True, max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=500; total time= 4.5s
[CV] END bootstrap=False, max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=100; total time= 1.3s
[CV] END bootstrap=False, max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=100; total time= 1.3s
[CV] END bootstrap=True, max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=200; total time= 2.8s
[CV] END bootstrap=False, max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=500; total time= 8.6s
[CV] END bootstrap=False, max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time= 1.7s
[CV] END bootstrap=True, max_depth=30, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=200; total time= 2.5s
[CV] END bootstrap=False, max_depth=40, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=300; total time= 5.1s
[CV] END bootstrap=True, max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 1.3s
[CV] END bootstrap=False, max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=500; total time= 8.4s
[CV] END bootstrap=False, max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=300; total time= 3.9s
[CV] END bootstrap=True, max_depth=40, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=200; total time= 2.2s
[CV] END bootstrap=False, max_depth=30, max_features=auto, min_samples_leaf=2,

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min_samples_split=10, n_estimators=500; total time= 0.0s
[CV] END bootstrap=False, max_depth=30, max_features=auto, min_samples_leaf=2,
min_samples_split=10, n_estimators=500; total time= 0.0s
[CV] END bootstrap=False, max_depth=30, max_features=auto, min_samples_leaf=2,
min_samples_split=10, n_estimators=500; total time= 0.0s
[CV] END bootstrap=True, max_depth=40, max_features=auto, min_samples_leaf=4,
min_samples_split=10, n_estimators=100; total time= 0.0s
[CV] END bootstrap=True, max_depth=40, max_features=auto, min_samples_leaf=4,
min_samples_split=10, n_estimators=100; total time= 0.0s
[CV] END bootstrap=True, max_depth=40, max_features=auto, min_samples_leaf=4,
min_samples_split=10, n_estimators=100; total time= 0.0s
[CV] END bootstrap=True, max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=200; total time= 2.1s
[CV] END bootstrap=True, max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=300; total time= 2.4s
[CV] END colsample_bytree=0.8, learning_rate=0.2, max_depth=3, n_estimators=300,
reg_alpha=0.1, reg_lambda=1.5, subsample=1.0; total time= 0.1s
[CV] END colsample_bytree=0.6, learning_rate=0.05, max_depth=3,
n_estimators=200, reg_alpha=0, reg_lambda=2, subsample=0.8; total time= 0.1s
[CV] END colsample_bytree=0.6, learning_rate=0.05, max_depth=3,
n_estimators=200, reg_alpha=0, reg_lambda=2, subsample=0.8; total time= 0.1s
[CV] END colsample_bytree=1.0, learning_rate=0.1, max_depth=3, n_estimators=500,
reg_alpha=1, reg_lambda=2, subsample=0.8; total time= 0.2s
[CV] END colsample_bytree=1.0, learning_rate=0.1, max_depth=3, n_estimators=500,
reg_alpha=1, reg_lambda=2, subsample=0.8; total time= 0.3s
[CV] END colsample_bytree=0.8, learning_rate=0.2, max_depth=10,
n_estimators=500, reg_alpha=0.1, reg_lambda=2, subsample=0.6; total time= 3.2s
[CV] END colsample_bytree=0.8, learning_rate=0.05, max_depth=7,
n_estimators=300, reg_alpha=0, reg_lambda=1.5, subsample=0.6; total time= 0.6s
[CV] END colsample_bytree=1.0, learning_rate=0.1, max_depth=7, n_estimators=100,
reg_alpha=1, reg_lambda=1, subsample=0.8; total time= 0.3s
[CV] END colsample_bytree=1.0, learning_rate=0.1, max_depth=7, n_estimators=100,
reg_alpha=1, reg_lambda=1, subsample=0.8; total time= 0.2s
[CV] END colsample_bytree=0.8, learning_rate=0.2, max_depth=10,
n_estimators=200, reg_alpha=0.1, reg_lambda=1, subsample=0.8; total time= 1.6s
[CV] END colsample_bytree=0.8, learning_rate=0.01, max_depth=7,
n_estimators=500, reg_alpha=1, reg_lambda=1.5, subsample=0.8; total time= 1.3s
[CV] END colsample_bytree=0.6, learning_rate=0.01, max_depth=5,
n_estimators=500, reg_alpha=0, reg_lambda=1, subsample=0.6; total time= 0.5s
[CV] END colsample_bytree=1.0, learning_rate=0.1, max_depth=10,
n_estimators=100, reg_alpha=0.1, reg_lambda=1.5, subsample=1.0; total time=
0.7s
[CV] END colsample_bytree=0.6, learning_rate=0.1, max_depth=10,
n_estimators=300, reg_alpha=1, reg_lambda=2, subsample=0.8; total time= 1.9s
[CV] END colsample_bytree=0.8, learning_rate=0.1, max_depth=7, n_estimators=300,
reg_alpha=1, reg_lambda=2, subsample=1.0; total time= 0.8s
[CV] END colsample_bytree=0.8, learning_rate=0.01, max_depth=10,
n_estimators=100, reg_alpha=0.1, reg_lambda=1, subsample=0.6; total time= 0.7s

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[CV] END colsample_bytree=0.8, learning_rate=0.1, max_depth=7, n_estimators=100, reg_alpha=0.1, reg_lambda=2, subsample=0.8; total time= 0.2s

[CV] END colsample_bytree=0.6, learning_rate=0.2, max_depth=5, n_estimators=300, reg_alpha=1, reg_lambda=1, subsample=1.0; total time= 0.3s

[CV] END colsample_bytree=0.6, learning_rate=0.05, max_depth=10, n_estimators=500, reg_alpha=1, reg_lambda=1.5, subsample=1.0; total time= 3.0s

[CV] END colsample_bytree=0.6, learning_rate=0.01, max_depth=5, n_estimators=100, reg_alpha=1, reg_lambda=1.5, subsample=0.8; total time= 0.1s

[CV] END colsample_bytree=0.6, learning_rate=0.05, max_depth=10, n_estimators=100, reg_alpha=0.1, reg_lambda=1.5, subsample=0.8; total time= 0.8s

[CV] END colsample_bytree=0.6, learning_rate=0.05, max_depth=10, n_estimators=100, reg_alpha=0.1, reg_lambda=1.5, subsample=0.8; total time= 0.7s

[CV] END colsample_bytree=1.0, learning_rate=0.2, max_depth=7, n_estimators=500, reg_alpha=0, reg_lambda=1, subsample=1.0; total time= 1.3s

[CV] END colsample_bytree=1.0, learning_rate=0.05, max_depth=7, n_estimators=100, reg_alpha=0.1, reg_lambda=1.5, subsample=0.8; total time= 0.3s

[CV] END colsample_bytree=0.8, learning_rate=0.1, max_depth=7, n_estimators=500, reg_alpha=0.1, reg_lambda=2, subsample=0.6; total time= 1.3s

[CV] END colsample_bytree=0.8, learning_rate=0.1, max_depth=5, n_estimators=200, reg_alpha=1, reg_lambda=1, subsample=1.0; total time= 0.2s

[CV] END colsample_bytree=0.6, learning_rate=0.1, max_depth=5, n_estimators=100, reg_alpha=0, reg_lambda=1.5, subsample=0.6; total time= 0.1s

[CV] END colsample_bytree=0.6, learning_rate=0.1, max_depth=5, n_estimators=100, reg_alpha=0, reg_lambda=1.5, subsample=0.6; total time= 0.1s

[CV] END colsample_bytree=0.8, learning_rate=0.01, max_depth=3, n_estimators=300, reg_alpha=1, reg_lambda=2, subsample=0.6; total time= 0.2s

[CV] END colsample_bytree=0.8, learning_rate=0.01, max_depth=3, n_estimators=300, reg_alpha=1, reg_lambda=2, subsample=0.6; total time= 0.2s

[CV] END colsample_bytree=0.6, learning_rate=0.01, max_depth=5, n_estimators=500, reg_alpha=0, reg_lambda=1, subsample=0.6; total time= 0.5s

[CV] END colsample_bytree=0.8, learning_rate=0.1, max_depth=10, n_estimators=500, reg_alpha=0, reg_lambda=2, subsample=1.0; total time= 3.4s

[CV] END colsample_bytree=0.8, learning_rate=0.05, max_depth=5, n_estimators=500, reg_alpha=0.1, reg_lambda=1.5, subsample=1.0; total time= 0.5s

[CV] END colsample_bytree=0.8, learning_rate=0.01, max_depth=7, n_estimators=500, reg_alpha=0.1, reg_lambda=2, subsample=0.8; total time= 1.2s

[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1, min_samples_split=2, n_estimators=200; total time= 1.9s

[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1, min_samples_split=2, n_estimators=200; total time= 1.9s

[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1, min_samples_split=2, n_estimators=300; total time= 2.8s

[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1, min_samples_split=2, n_estimators=300; total time= 2.9s

[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
 min_samples_split=5, n_estimators=200; total time= 1.8s
 [CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
 min_samples_split=5, n_estimators=200; total time= 1.8s
 [CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
 min_samples_split=5, n_estimators=300; total time= 2.7s
 [CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
 min_samples_split=5, n_estimators=300; total time= 2.7s
 [CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
 min_samples_split=10, n_estimators=100; total time= 1.0s
 [CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
 min_samples_split=10, n_estimators=200; total time= 1.8s
 [CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
 min_samples_split=2, n_estimators=200; total time= 1.8s
 [CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
 min_samples_split=5, n_estimators=100; total time= 0.9s
 [CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
 min_samples_split=5, n_estimators=300; total time= 2.7s
 [CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
 min_samples_split=2, n_estimators=100; total time= 0.9s
 [CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
 min_samples_split=2, n_estimators=200; total time= 1.8s
 [CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
 min_samples_split=5, n_estimators=100; total time= 0.9s
 [CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
 min_samples_split=5, n_estimators=300; total time= 2.7s
 [CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
 min_samples_split=2, n_estimators=100; total time= 0.9s
 [CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
 min_samples_split=2, n_estimators=200; total time= 1.9s
 [CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
 min_samples_split=5, n_estimators=200; total time= 1.7s
 [CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
 min_samples_split=10, n_estimators=100; total time= 0.9s
 [CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
 min_samples_split=10, n_estimators=300; total time= 2.6s
 [CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
 min_samples_split=10, n_estimators=200; total time= 2.4s
 [CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
 min_samples_split=10, n_estimators=200; total time= 2.4s
 [CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
 min_samples_split=10, n_estimators=200; total time= 2.3s
 [CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
 min_samples_split=10, n_estimators=300; total time= 3.7s
 [CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
 min_samples_split=2, n_estimators=200; total time= 2.3s
 [CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
 min_samples_split=2, n_estimators=200; total time= 2.2s

[illegible]

[CV] END max_depth=30, max_features=log2, min_samples_leaf=1,
 min_samples_split=5, n_estimators=300; total time= 3.9s
 [CV] END max_depth=30, max_features=log2, min_samples_leaf=2,
 min_samples_split=2, n_estimators=300; total time= 3.9s
 [CV] END max_depth=30, max_features=log2, min_samples_leaf=2,
 min_samples_split=5, n_estimators=300; total time= 3.9s
 [CV] END max_depth=30, max_features=log2, min_samples_leaf=4,
 min_samples_split=2, n_estimators=200; total time= 2.2s
 [CV] END max_depth=30, max_features=log2, min_samples_leaf=4,
 min_samples_split=5, n_estimators=100; total time= 1.1s
 [CV] END max_depth=30, max_features=log2, min_samples_leaf=4,
 min_samples_split=5, n_estimators=300; total time= 3.4s
 [CV] END bootstrap=True, max_depth=30, max_features=log2, min_samples_leaf=4,
 min_samples_split=2, n_estimators=500; total time= 5.6s
 [CV] END bootstrap=False, max_depth=40, max_features=log2, min_samples_leaf=1,
 min_samples_split=5, n_estimators=500; total time= 10.1s
 [CV] END bootstrap=True, max_depth=10, max_features=sqrt, min_samples_leaf=2,
 min_samples_split=2, n_estimators=300; total time= 2.9s
 [CV] END bootstrap=True, max_depth=10, max_features=sqrt, min_samples_leaf=2,
 min_samples_split=2, n_estimators=300; total time= 2.7s
 [CV] END bootstrap=True, max_depth=40, max_features=auto, min_samples_leaf=2,
 min_samples_split=5, n_estimators=100; total time= 0.0s
 [CV] END bootstrap=True, max_depth=40, max_features=auto, min_samples_leaf=2,
 min_samples_split=5, n_estimators=100; total time= 0.0s
 [CV] END bootstrap=True, max_depth=30, max_features=auto, min_samples_leaf=1,
 min_samples_split=10, n_estimators=200; total time= 0.0s
 [CV] END bootstrap=True, max_depth=30, max_features=auto, min_samples_leaf=1,
 min_samples_split=10, n_estimators=200; total time= 0.0s
 [CV] END bootstrap=True, max_depth=30, max_features=auto, min_samples_leaf=1,
 min_samples_split=10, n_estimators=200; total time= 0.0s
 [CV] END bootstrap=True, max_depth=40, max_features=sqrt, min_samples_leaf=4,
 min_samples_split=2, n_estimators=500; total time= 5.4s
 [CV] END bootstrap=True, max_depth=40, max_features=sqrt, min_samples_leaf=2,
 min_samples_split=5, n_estimators=200; total time= 2.5s
 [CV] END bootstrap=True, max_depth=30, max_features=sqrt, min_samples_leaf=1,
 min_samples_split=10, n_estimators=500; total time= 5.9s
 [CV] END bootstrap=True, max_depth=20, max_features=sqrt, min_samples_leaf=4,
 min_samples_split=2, n_estimators=200; total time= 2.1s
 [CV] END bootstrap=False, max_depth=None, max_features=log2, min_samples_leaf=1,
 min_samples_split=5, n_estimators=200; total time= 4.0s
 [CV] END bootstrap=True, max_depth=20, max_features=log2, min_samples_leaf=2,
 min_samples_split=10, n_estimators=200; total time= 2.3s
 [CV] END bootstrap=False, max_depth=30, max_features=log2, min_samples_leaf=2,
 min_samples_split=5, n_estimators=300; total time= 5.9s
 [CV] END bootstrap=False, max_depth=None, max_features=log2, min_samples_leaf=1,
 min_samples_split=10, n_estimators=200; total time= 3.6s
 [CV] END bootstrap=False, max_depth=30, max_features=sqrt, min_samples_leaf=4,
 min_samples_split=10, n_estimators=200; total time= 3.3s

[CV] END bootstrap=True, max_depth=20, max_features=log2, min_samples_leaf=1, min_samples_split=2, n_estimators=200; total time= 2.9s

[CV] END bootstrap=False, max_depth=20, max_features=sqrt, min_samples_leaf=4, min_samples_split=2, n_estimators=500; total time= 8.6s

[CV] END bootstrap=False, max_depth=None, max_features=sqrt, min_samples_leaf=2, min_samples_split=10, n_estimators=100; total time= 1.8s

[CV] END bootstrap=True, max_depth=10, max_features=auto, min_samples_leaf=1, min_samples_split=5, n_estimators=200; total time= 0.0s

[CV] END bootstrap=True, max_depth=10, max_features=auto, min_samples_leaf=1, min_samples_split=5, n_estimators=200; total time= 0.0s

[CV] END bootstrap=True, max_depth=10, max_features=auto, min_samples_leaf=1, min_samples_split=5, n_estimators=200; total time= 0.0s

[CV] END bootstrap=False, max_depth=None, max_features=sqrt, min_samples_leaf=1, min_samples_split=2, n_estimators=300; total time= 6.6s

[CV] END bootstrap=False, max_depth=30, max_features=log2, min_samples_leaf=2, min_samples_split=2, n_estimators=200; total time= 4.0s

[CV] END bootstrap=True, max_depth=None, max_features=log2, min_samples_leaf=4, min_samples_split=10, n_estimators=500; total time= 5.4s

[CV] END bootstrap=False, max_depth=10, max_features=log2, min_samples_leaf=4, min_samples_split=2, n_estimators=300; total time= 3.9s

[CV] END bootstrap=False, max_depth=40, max_features=log2, min_samples_leaf=4, min_samples_split=2, n_estimators=200; total time= 3.4s

[CV] END bootstrap=True, max_depth=None, max_features=log2, min_samples_leaf=4, min_samples_split=5, n_estimators=200; total time= 2.2s

[CV] END colsample_bytree=0.6, learning_rate=0.05, max_depth=10, n_estimators=500, reg_alpha=1, reg_lambda=1.5, subsample=1.0; total time= 3.1s

[CV] END colsample_bytree=0.6, learning_rate=0.2, max_depth=10, n_estimators=300, reg_alpha=0.1, reg_lambda=1, subsample=1.0; total time= 1.7s

[CV] END colsample_bytree=1.0, learning_rate=0.2, max_depth=7, n_estimators=500, reg_alpha=0, reg_lambda=1, subsample=1.0; total time= 1.3s

[CV] END colsample_bytree=1.0, learning_rate=0.2, max_depth=3, n_estimators=500, reg_alpha=0.1, reg_lambda=1, subsample=0.8; total time= 0.2s

[CV] END colsample_bytree=0.8, learning_rate=0.1, max_depth=7, n_estimators=500, reg_alpha=0.1, reg_lambda=2, subsample=0.6; total time= 1.1s

[CV] END colsample_bytree=0.8, learning_rate=0.01, max_depth=7, n_estimators=500, reg_alpha=1, reg_lambda=1.5, subsample=0.8; total time= 1.3s

[CV] END colsample_bytree=0.8, learning_rate=0.1, max_depth=10, n_estimators=500, reg_alpha=0, reg_lambda=2, subsample=1.0; total time= 3.2s

[CV] END colsample_bytree=0.8, learning_rate=0.05, max_depth=7, n_estimators=300, reg_alpha=0, reg_lambda=1.5, subsample=1.0; total time= 0.7s

[CV] END colsample_bytree=0.6, learning_rate=0.01, max_depth=7, n_estimators=100, reg_alpha=1, reg_lambda=2, subsample=0.8; total time= 0.2s

[CV] END colsample_bytree=0.8, learning_rate=0.1, max_depth=7, n_estimators=100, reg_alpha=0.1, reg_lambda=2, subsample=0.8; total time= 0.2s

[CV] END colsample_bytree=0.6, learning_rate=0.2, max_depth=3, n_estimators=300, reg_alpha=0.1, reg_lambda=1.5, subsample=0.8; total time= 0.2s

[CV] END colsample_bytree=0.8, learning_rate=0.05, max_depth=10, n_estimators=300, reg_alpha=1, reg_lambda=1, subsample=0.6; total time= 1.4s

[CV] END colsample_bytree=0.8, learning_rate=0.2, max_depth=3, n_estimators=300, reg_alpha=0.1, reg_lambda=1.5, subsample=1.0; total time= 0.1s

[CV] END colsample_bytree=0.6, learning_rate=0.05, max_depth=3, n_estimators=200, reg_alpha=0, reg_lambda=2, subsample=0.8; total time= 0.1s

[CV] END colsample_bytree=0.6, learning_rate=0.05, max_depth=3, n_estimators=200, reg_alpha=0, reg_lambda=2, subsample=0.8; total time= 0.1s

[CV] END colsample_bytree=1.0, learning_rate=0.1, max_depth=3, n_estimators=500, reg_alpha=1, reg_lambda=2, subsample=0.8; total time= 0.3s

[CV] END colsample_bytree=1.0, learning_rate=0.1, max_depth=3, n_estimators=500, reg_alpha=1, reg_lambda=2, subsample=0.8; total time= 0.3s

[CV] END colsample_bytree=0.8, learning_rate=0.2, max_depth=10, n_estimators=500, reg_alpha=0.1, reg_lambda=2, subsample=0.6; total time= 3.3s

[CV] END colsample_bytree=0.8, learning_rate=0.05, max_depth=7, n_estimators=300, reg_alpha=0, reg_lambda=1.5, subsample=0.6; total time= 0.6s

[CV] END colsample_bytree=0.6, learning_rate=0.1, max_depth=7, n_estimators=500, reg_alpha=1, reg_lambda=1.5, subsample=1.0; total time= 0.9s

[CV] END colsample_bytree=1.0, learning_rate=0.05, max_depth=7, n_estimators=100, reg_alpha=0.1, reg_lambda=1.5, subsample=0.8; total time= 0.3s

[CV] END colsample_bytree=1.0, learning_rate=0.2, max_depth=3, n_estimators=500, reg_alpha=0.1, reg_lambda=1, subsample=0.8; total time= 0.3s

[CV] END colsample_bytree=0.6, learning_rate=0.05, max_depth=3, n_estimators=200, reg_alpha=0.1, reg_lambda=2, subsample=0.6; total time= 0.1s

[CV] END colsample_bytree=0.6, learning_rate=0.1, max_depth=7, n_estimators=100, reg_alpha=0, reg_lambda=1, subsample=1.0; total time= 0.3s

[CV] END colsample_bytree=0.6, learning_rate=0.1, max_depth=7, n_estimators=100, reg_alpha=0, reg_lambda=1, subsample=1.0; total time= 0.2s

[CV] END colsample_bytree=0.8, learning_rate=0.05, max_depth=10, n_estimators=300, reg_alpha=1, reg_lambda=1, subsample=1.0; total time= 2.3s

[CV] END colsample_bytree=0.8, learning_rate=0.01, max_depth=5, n_estimators=300, reg_alpha=0.1, reg_lambda=1, subsample=0.6; total time= 0.3s

[CV] END colsample_bytree=0.6, learning_rate=0.1, max_depth=10, n_estimators=300, reg_alpha=1, reg_lambda=2, subsample=0.8; total time= 1.7s

[CV] END colsample_bytree=0.8, learning_rate=0.1, max_depth=7, n_estimators=300, reg_alpha=1, reg_lambda=2, subsample=1.0; total time= 0.8s

[CV] END colsample_bytree=0.6, learning_rate=0.05, max_depth=5, n_estimators=300, reg_alpha=0, reg_lambda=2, subsample=0.6; total time= 0.3s

[CV] END colsample_bytree=0.8, learning_rate=0.05, max_depth=5, n_estimators=500, reg_alpha=0.1, reg_lambda=1.5, subsample=1.0; total time= 0.5s

[CV] END colsample_bytree=0.8, learning_rate=0.1, max_depth=7, n_estimators=100, reg_alpha=0.1, reg_lambda=2, subsample=0.8; total time= 0.2s

[CV] END colsample_bytree=0.8, learning_rate=0.1, max_depth=3, n_estimators=100, reg_alpha=1, reg_lambda=1, subsample=1.0; total time= 0.1s

[CV] END colsample_bytree=0.6, learning_rate=0.2, max_depth=3, n_estimators=300, reg_alpha=0.1, reg_lambda=1.5, subsample=0.8; total time= 0.2s

[CV] END colsample_bytree=0.8, learning_rate=0.05, max_depth=10, n_estimators=300, reg_alpha=1, reg_lambda=1, subsample=0.6; total time= 1.3s

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[CV] END max_depth=30, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=200; total time= 2.3s
[CV] END max_depth=30, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=300; total time= 3.4s
[CV] END max_depth=30, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=300; total time= 3.5s
[CV] END max_depth=30, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=300; total time= 3.6s
[CV] END max_depth=30, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=200; total time= 3.0s
[CV] END max_depth=30, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=300; total time= 3.8s
[CV] END max_depth=30, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=300; total time= 3.6s
[CV] END max_depth=30, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=100; total time= 1.3s
[CV] END max_depth=30, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time= 3.9s
[CV] END max_depth=30, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=300; total time= 3.5s
[CV] END max_depth=30, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=200; total time= 2.2s
[CV] END max_depth=30, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=100; total time= 1.1s
[CV] END max_depth=30, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=300; total time= 2.9s
[CV] END bootstrap=True, max_depth=30, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=500; total time= 5.7s
[CV] END bootstrap=False, max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 2.1s
[CV] END bootstrap=False, max_depth=40, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 1.9s
[CV] END bootstrap=False, max_depth=40, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 2.1s
[CV] END bootstrap=False, max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=200; total time= 4.1s
[CV] END bootstrap=False, max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=200; total time= 4.2s
[CV] END bootstrap=True, max_depth=30, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=200; total time= 2.7s
[CV] END bootstrap=True, max_depth=40, max_features=auto, min_samples_leaf=2,
min_samples_split=5, n_estimators=100; total time= 0.0s
[CV] END bootstrap=False, max_depth=30, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=100; total time= 1.9s
[CV] END bootstrap=True, max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time= 1.1s
[CV] END bootstrap=True, max_depth=40, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=200; total time= 2.5s

```

[CV] END bootstrap=True, max_depth=30, max_features=sqrt, min_samples_leaf=4, min_samples_split=5, n_estimators=100; total time= 1.1s

[CV] END bootstrap=True, max_depth=30, max_features=sqrt, min_samples_leaf=1, min_samples_split=10, n_estimators=500; total time= 6.0s

[CV] END bootstrap=True, max_depth=10, max_features=sqrt, min_samples_leaf=4, min_samples_split=5, n_estimators=300; total time= 2.7s

[CV] END bootstrap=False, max_depth=None, max_features=log2, min_samples_leaf=1, min_samples_split=5, n_estimators=200; total time= 4.0s

[CV] END bootstrap=True, max_depth=30, max_features=sqrt, min_samples_leaf=4, min_samples_split=5, n_estimators=200; total time= 2.3s

[CV] END bootstrap=False, max_depth=40, max_features=auto, min_samples_leaf=2, min_samples_split=10, n_estimators=100; total time= 0.0s

[CV] END bootstrap=False, max_depth=40, max_features=auto, min_samples_leaf=2, min_samples_split=10, n_estimators=100; total time= 0.0s

[CV] END bootstrap=False, max_depth=40, max_features=auto, min_samples_leaf=2, min_samples_split=10, n_estimators=100; total time= 0.0s

[CV] END bootstrap=True, max_depth=10, max_features=auto, min_samples_leaf=1, min_samples_split=2, n_estimators=200; total time= 0.0s

[CV] END bootstrap=True, max_depth=10, max_features=auto, min_samples_leaf=1, min_samples_split=2, n_estimators=200; total time= 0.0s

[CV] END bootstrap=True, max_depth=10, max_features=auto, min_samples_leaf=1, min_samples_split=2, n_estimators=200; total time= 0.0s

[CV] END bootstrap=True, max_depth=None, max_features=log2, min_samples_leaf=2, min_samples_split=5, n_estimators=100; total time= 1.3s

[CV] END bootstrap=True, max_depth=None, max_features=log2, min_samples_leaf=2, min_samples_split=5, n_estimators=100; total time= 1.2s

[CV] END bootstrap=True, max_depth=40, max_features=sqrt, min_samples_leaf=4, min_samples_split=2, n_estimators=200; total time= 2.5s

[CV] END bootstrap=True, max_depth=10, max_features=log2, min_samples_leaf=2, min_samples_split=5, n_estimators=500; total time= 4.5s

[CV] END bootstrap=False, max_depth=10, max_features=sqrt, min_samples_leaf=1, min_samples_split=10, n_estimators=100; total time= 1.3s

[CV] END bootstrap=True, max_depth=20, max_features=log2, min_samples_leaf=1, min_samples_split=2, n_estimators=200; total time= 3.0s

[CV] END bootstrap=False, max_depth=20, max_features=log2, min_samples_leaf=4, min_samples_split=2, n_estimators=300; total time= 5.1s

[CV] END bootstrap=False, max_depth=20, max_features=sqrt, min_samples_leaf=4, min_samples_split=10, n_estimators=200; total time= 3.4s

[CV] END bootstrap=False, max_depth=20, max_features=sqrt, min_samples_leaf=4, min_samples_split=10, n_estimators=200; total time= 3.3s

[CV] END bootstrap=False, max_depth=None, max_features=sqrt, min_samples_leaf=1, min_samples_split=2, n_estimators=300; total time= 6.7s

[CV] END bootstrap=False, max_depth=30, max_features=auto, min_samples_leaf=2, min_samples_split=5, n_estimators=200; total time= 0.0s

[CV] END bootstrap=False, max_depth=30, max_features=auto, min_samples_leaf=2, min_samples_split=5, n_estimators=200; total time= 0.0s

[CV] END bootstrap=False, max_depth=30, max_features=auto, min_samples_leaf=2, min_samples_split=5, n_estimators=200; total time= 0.0s

[CV] END bootstrap=False, max_depth=30, max_features=log2, min_samples_leaf=1, min_samples_split=10, n_estimators=200; total time= 3.7s

[CV] END bootstrap=True, max_depth=None, max_features=log2, min_samples_leaf=4, min_samples_split=10, n_estimators=500; total time= 5.4s

[CV] END bootstrap=False, max_depth=10, max_features=log2, min_samples_leaf=4, min_samples_split=2, n_estimators=300; total time= 3.8s

[CV] END bootstrap=False, max_depth=40, max_features=log2, min_samples_leaf=4, min_samples_split=2, n_estimators=200; total time= 3.4s

[CV] END bootstrap=True, max_depth=None, max_features=log2, min_samples_leaf=4, min_samples_split=5, n_estimators=200; total time= 2.2s

[CV] END colsample_bytree=0.6, learning_rate=0.05, max_depth=10, n_estimators=500, reg_alpha=1, reg_lambda=1.5, subsample=1.0; total time= 2.9s

[CV] END colsample_bytree=0.6, learning_rate=0.01, max_depth=5, n_estimators=100, reg_alpha=1, reg_lambda=1.5, subsample=0.8; total time= 0.1s

[CV] END colsample_bytree=0.6, learning_rate=0.2, max_depth=10, n_estimators=300, reg_alpha=0.1, reg_lambda=1, subsample=1.0; total time= 1.7s

[CV] END colsample_bytree=0.6, learning_rate=0.1, max_depth=7, n_estimators=500, reg_alpha=1, reg_lambda=1.5, subsample=1.0; total time= 1.0s

[CV] END colsample_bytree=0.8, learning_rate=0.2, max_depth=10, n_estimators=200, reg_alpha=0.1, reg_lambda=1, subsample=0.8; total time= 1.4s

[CV] END colsample_bytree=0.8, learning_rate=0.01, max_depth=7, n_estimators=500, reg_alpha=1, reg_lambda=1.5, subsample=0.8; total time= 1.2s

[CV] END colsample_bytree=0.8, learning_rate=0.1, max_depth=5, n_estimators=200, reg_alpha=0, reg_lambda=2, subsample=0.8; total time= 0.2s

[CV] END colsample_bytree=0.8, learning_rate=0.1, max_depth=5, n_estimators=200, reg_alpha=0, reg_lambda=2, subsample=0.8; total time= 0.2s

[CV] END colsample_bytree=0.8, learning_rate=0.1, max_depth=10, n_estimators=500, reg_alpha=0, reg_lambda=2, subsample=1.0; total time= 3.1s

[CV] END colsample_bytree=0.6, learning_rate=0.05, max_depth=5, n_estimators=300, reg_alpha=0, reg_lambda=2, subsample=0.6; total time= 0.2s

[CV] END colsample_bytree=0.8, learning_rate=0.05, max_depth=5, n_estimators=500, reg_alpha=0.1, reg_lambda=1.5, subsample=1.0; total time= 0.4s

[CV] END colsample_bytree=0.6, learning_rate=0.01, max_depth=7, n_estimators=100, reg_alpha=1, reg_lambda=2, subsample=0.8; total time= 0.2s

[CV] END colsample_bytree=0.8, learning_rate=0.1, max_depth=7, n_estimators=100, reg_alpha=0.1, reg_lambda=2, subsample=0.8; total time= 0.2s

[CV] END colsample_bytree=0.6, learning_rate=0.2, max_depth=3, n_estimators=300, reg_alpha=0.1, reg_lambda=1.5, subsample=0.8; total time= 0.1s

[CV] END colsample_bytree=0.6, learning_rate=0.2, max_depth=5, n_estimators=300, reg_alpha=1, reg_lambda=1, subsample=1.0; total time= 0.3s

[CV] END colsample_bytree=0.6, learning_rate=0.05, max_depth=10, n_estimators=500, reg_alpha=1, reg_lambda=1.5, subsample=1.0; total time= 3.1s

[CV] END colsample_bytree=0.6, learning_rate=0.2, max_depth=10, n_estimators=300, reg_alpha=0.1, reg_lambda=1, subsample=1.0; total time= 1.7s

[CV] END colsample_bytree=0.6, learning_rate=0.1, max_depth=7, n_estimators=500, reg_alpha=1, reg_lambda=1.5, subsample=1.0; total time= 1.0s

[CV] END colsample_bytree=0.8, learning_rate=0.2, max_depth=10,

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n_estimators=200, reg_alpha=0.1, reg_lambda=1, subsample=0.8; total time= 1.4s
[CV] END colsample_bytree=0.8, learning_rate=0.01, max_depth=7,
n_estimators=500, reg_alpha=1, reg_lambda=1.5, subsample=0.8; total time= 1.3s
[CV] END colsample_bytree=0.8, learning_rate=0.1, max_depth=5, n_estimators=200,
reg_alpha=0, reg_lambda=2, subsample=0.8; total time= 0.2s
[CV] END colsample_bytree=0.8, learning_rate=0.1, max_depth=10,
n_estimators=500, reg_alpha=0, reg_lambda=2, subsample=1.0; total time= 3.1s
[CV] END colsample_bytree=0.8, learning_rate=0.05, max_depth=7,
n_estimators=300, reg_alpha=0, reg_lambda=1.5, subsample=1.0; total time= 0.6s
[CV] END colsample_bytree=0.8, learning_rate=0.01, max_depth=10,
n_estimators=100, reg_alpha=0.1, reg_lambda=1, subsample=0.6; total time= 0.7s
[CV] END colsample_bytree=0.8, learning_rate=0.1, max_depth=3, n_estimators=100,
reg_alpha=1, reg_lambda=1, subsample=1.0; total time= 0.1s
[CV] END colsample_bytree=0.6, learning_rate=0.2, max_depth=5, n_estimators=300,
reg_alpha=1, reg_lambda=1, subsample=1.0; total time= 0.2s
[CV] END colsample_bytree=0.8, learning_rate=0.05, max_depth=10,
n_estimators=300, reg_alpha=1, reg_lambda=1, subsample=0.6; total time= 1.2s
[CV] END max_depth=None, max_features=auto, min_samples_leaf=1,
min_samples_split=2, n_estimators=100; total time= 0.0s
[CV] END max_depth=None, max_features=auto, min_samples_leaf=1,
min_samples_split=2, n_estimators=300; total time= 0.0s
[CV] END max_depth=None, max_features=auto, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 0.0s
[CV] END max_depth=None, max_features=auto, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 0.0s
[CV] END max_depth=None, max_features=auto, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 0.0s
[CV] END max_depth=None, max_features=auto, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 0.0s
[CV] END max_depth=None, max_features=auto, min_samples_leaf=1,
min_samples_split=5, n_estimators=200; total time= 0.0s
[CV] END max_depth=None, max_features=auto, min_samples_leaf=1,
min_samples_split=5, n_estimators=200; total time= 0.0s
[CV] END max_depth=None, max_features=auto, min_samples_leaf=1,
min_samples_split=5, n_estimators=200; total time= 0.0s
[CV] END max_depth=None, max_features=auto, min_samples_leaf=1,
min_samples_split=5, n_estimators=200; total time= 0.0s
[CV] END max_depth=None, max_features=auto, min_samples_leaf=1,
min_samples_split=5, n_estimators=300; total time= 0.0s
[CV] END max_depth=None, max_features=auto, min_samples_leaf=2,
min_samples_split=2, n_estimators=100; total time= 0.0s
[CV] END max_depth=None, max_features=auto, min_samples_leaf=2,
min_samples_split=2, n_estimators=200; total time= 0.0s
[CV] END max_depth=None, max_features=auto, min_samples_leaf=2,
min_samples_split=5, n_estimators=200; total time= 0.0s
[CV] END max_depth=None, max_features=auto, min_samples_leaf=2,
min_samples_split=5, n_estimators=200; total time= 0.0s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 1.3s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=200; total time= 2.9s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,

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[illegible]

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min_samples_split=5, n_estimators=100; total time= 0.9s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=200; total time= 1.8s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=300; total time= 2.7s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=300; total time= 2.7s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=300; total time= 2.7s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=100; total time= 0.9s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=300; total time= 2.8s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=100; total time= 0.9s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=200; total time= 1.8s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=200; total time= 1.8s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=200; total time= 1.8s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time= 0.9s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=300; total time= 2.8s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=100; total time= 0.9s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=200; total time= 1.8s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=200; total time= 1.9s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=200; total time= 2.7s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=200; total time= 2.7s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=300; total time= 3.9s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=300; total time= 4.2s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=100; total time= 1.2s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=200; total time= 2.3s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=200; total time= 2.3s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=200; total time= 2.2s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,

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min_samples_split=5, n_estimators=200; total time= 2.6s
[CV] END max_depth=30, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=100; total time= 1.2s
[CV] END max_depth=30, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=200; total time= 2.3s
[CV] END max_depth=30, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=200; total time= 2.6s
[CV] END max_depth=30, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=100; total time= 1.2s
[CV] END max_depth=30, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time= 3.9s
[CV] END max_depth=30, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=100; total time= 1.1s
[CV] END max_depth=30, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=200; total time= 2.2s
[CV] END max_depth=30, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=200; total time= 2.2s
[CV] END max_depth=30, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=100; total time= 1.1s
[CV] END max_depth=30, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=300; total time= 2.8s
[CV] END bootstrap=True, max_depth=30, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=500; total time= 5.7s
[CV] END bootstrap=False, max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 2.0s
[CV] END bootstrap=False, max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 2.0s
[CV] END bootstrap=False, max_depth=40, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 2.0s
[CV] END bootstrap=False, max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=200; total time= 4.3s
[CV] END bootstrap=True, max_depth=30, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=200; total time= 2.7s
[CV] END bootstrap=True, max_depth=30, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=200; total time= 2.6s
[CV] END bootstrap=True, max_depth=40, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=500; total time= 5.8s
[CV] END bootstrap=True, max_depth=30, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=100; total time= 1.1s
[CV] END bootstrap=True, max_depth=40, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=100; total time= 1.1s
[CV] END bootstrap=True, max_depth=30, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=500; total time= 6.0s
[CV] END bootstrap=True, max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=300; total time= 2.7s
[CV] END bootstrap=False, max_depth=20, max_features=auto, min_samples_leaf=1,
min_samples_split=5, n_estimators=200; total time= 0.0s
[CV] END bootstrap=False, max_depth=20, max_features=auto, min_samples_leaf=1,

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```

min_samples_split=5, n_estimators=200; total time= 0.0s
[CV] END bootstrap=False, max_depth=20, max_features=auto, min_samples_leaf=1,
min_samples_split=5, n_estimators=200; total time= 0.0s
[CV] END bootstrap=True, max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=300; total time= 3.8s
[CV] END bootstrap=True, max_depth=30, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=200; total time= 2.2s
[CV] END bootstrap=False, max_depth=30, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time= 5.8s
[CV] END bootstrap=False, max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=200; total time= 3.5s
[CV] END bootstrap=False, max_depth=30, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=200; total time= 3.3s
[CV] END bootstrap=False, max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=300; total time= 5.2s
[CV] END bootstrap=True, max_depth=40, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=500; total time= 5.6s
[CV] END bootstrap=False, max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time= 1.7s
[CV] END bootstrap=True, max_depth=30, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=200; total time= 2.5s
[CV] END bootstrap=False, max_depth=40, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=300; total time= 5.1s
[CV] END bootstrap=False, max_depth=30, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=200; total time= 3.6s
[CV] END bootstrap=True, max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=500; total time= 5.6s
[CV] END bootstrap=False, max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=300; total time= 3.9s
[CV] END bootstrap=True, max_depth=None, max_features=auto, min_samples_leaf=2,
min_samples_split=10, n_estimators=500; total time= 0.0s
[CV] END bootstrap=True, max_depth=None, max_features=auto, min_samples_leaf=2,
min_samples_split=10, n_estimators=500; total time= 0.0s
[CV] END bootstrap=True, max_depth=None, max_features=auto, min_samples_leaf=2,
min_samples_split=10, n_estimators=500; total time= 0.0s
[CV] END bootstrap=False, max_depth=30, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 2.0s
[CV] END bootstrap=True, max_depth=40, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=200; total time= 2.2s
[CV] END bootstrap=True, max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=300; total time= 2.6s
[CV] END colsample_bytree=1.0, learning_rate=0.01, max_depth=7,
n_estimators=500, reg_alpha=1, reg_lambda=1, subsample=0.8; total time= 1.6s
[CV] END colsample_bytree=0.8, learning_rate=0.2, max_depth=5, n_estimators=200,
reg_alpha=0.1, reg_lambda=1.5, subsample=0.6; total time= 0.2s
[CV] END colsample_bytree=0.8, learning_rate=0.2, max_depth=5, n_estimators=200,
reg_alpha=0.1, reg_lambda=1.5, subsample=0.6; total time= 0.2s
[CV] END colsample_bytree=0.8, learning_rate=0.1, max_depth=10,

```

```

n_estimators=100, reg_alpha=0, reg_lambda=1.5, subsample=0.6; total time=    0.7s
[CV] END colsample_bytree=0.6, learning_rate=0.01, max_depth=5,
n_estimators=100, reg_alpha=1, reg_lambda=1.5, subsample=0.8; total time=    0.1s
[CV] END colsample_bytree=0.6, learning_rate=0.01, max_depth=5,
n_estimators=100, reg_alpha=1, reg_lambda=1.5, subsample=0.8; total time=    0.1s
[CV] END colsample_bytree=0.6, learning_rate=0.05, max_depth=10,
n_estimators=100, reg_alpha=0.1, reg_lambda=1.5, subsample=0.8; total time=
0.7s
[CV] END colsample_bytree=0.6, learning_rate=0.05, max_depth=10,
n_estimators=100, reg_alpha=0.1, reg_lambda=1.5, subsample=0.8; total time=
0.7s
[CV] END colsample_bytree=1.0, learning_rate=0.2, max_depth=7, n_estimators=500,
reg_alpha=0, reg_lambda=1, subsample=1.0; total time=    1.3s
[CV] END colsample_bytree=1.0, learning_rate=0.05, max_depth=7,
n_estimators=100, reg_alpha=0.1, reg_lambda=1.5, subsample=0.8; total time=
0.3s
[CV] END colsample_bytree=1.0, learning_rate=0.2, max_depth=3, n_estimators=500,
reg_alpha=0.1, reg_lambda=1, subsample=0.8; total time=    0.3s
[CV] END colsample_bytree=0.6, learning_rate=0.05, max_depth=3,
n_estimators=200, reg_alpha=0.1, reg_lambda=2, subsample=0.6; total time=    0.1s
[CV] END colsample_bytree=0.6, learning_rate=0.1, max_depth=7, n_estimators=100,
reg_alpha=0, reg_lambda=1, subsample=1.0; total time=    0.2s
[CV] END colsample_bytree=0.8, learning_rate=0.05, max_depth=10,
n_estimators=300, reg_alpha=1, reg_lambda=1, subsample=1.0; total time=    2.1s
[CV] END colsample_bytree=1.0, learning_rate=0.1, max_depth=10,
n_estimators=100, reg_alpha=0.1, reg_lambda=1.5, subsample=1.0; total time=
0.8s
[CV] END colsample_bytree=0.6, learning_rate=0.2, max_depth=7, n_estimators=100,
reg_alpha=0.1, reg_lambda=2, subsample=0.8; total time=    0.2s
[CV] END colsample_bytree=0.8, learning_rate=0.2, max_depth=5, n_estimators=300,
reg_alpha=0.1, reg_lambda=2, subsample=0.8; total time=    0.4s
[CV] END colsample_bytree=0.8, learning_rate=0.2, max_depth=5, n_estimators=300,
reg_alpha=0.1, reg_lambda=2, subsample=0.8; total time=    0.3s
[CV] END colsample_bytree=1.0, learning_rate=0.01, max_depth=3,
n_estimators=500, reg_alpha=1, reg_lambda=1, subsample=0.8; total time=    0.3s
[CV] END colsample_bytree=1.0, learning_rate=0.05, max_depth=3,
n_estimators=100, reg_alpha=0, reg_lambda=1, subsample=1.0; total time=    0.1s
[CV] END colsample_bytree=1.0, learning_rate=0.05, max_depth=3,
n_estimators=100, reg_alpha=0, reg_lambda=1, subsample=1.0; total time=    0.1s
[CV] END colsample_bytree=0.6, learning_rate=0.05, max_depth=5,
n_estimators=500, reg_alpha=1, reg_lambda=2, subsample=0.8; total time=    0.5s
[CV] END colsample_bytree=0.8, learning_rate=0.05, max_depth=7,
n_estimators=300, reg_alpha=0, reg_lambda=1.5, subsample=1.0; total time=    0.7s
[CV] END colsample_bytree=0.8, learning_rate=0.01, max_depth=10,
n_estimators=100, reg_alpha=0.1, reg_lambda=1, subsample=0.6; total time=    0.7s
[CV] END colsample_bytree=0.8, learning_rate=0.1, max_depth=3, n_estimators=100,
reg_alpha=1, reg_lambda=1, subsample=1.0; total time=    0.1s
[CV] END colsample_bytree=0.8, learning_rate=0.1, max_depth=3, n_estimators=100,

```



```

reg_alpha=1, reg_lambda=1, subsample=1.0; total time= 0.1s
[CV] END colsample_bytree=0.6, learning_rate=0.2, max_depth=5, n_estimators=300,
reg_alpha=1, reg_lambda=1, subsample=1.0; total time= 0.2s
[CV] END colsample_bytree=0.8, learning_rate=0.05, max_depth=10,
n_estimators=300, reg_alpha=1, reg_lambda=1, subsample=0.6; total time= 1.4s
[CV] END colsample_bytree=1.0, learning_rate=0.01, max_depth=7,
n_estimators=500, reg_alpha=1, reg_lambda=1, subsample=0.8; total time= 1.5s
[CV] END colsample_bytree=0.8, learning_rate=0.2, max_depth=10,
n_estimators=500, reg_alpha=0.1, reg_lambda=2, subsample=0.6; total time= 3.3s
[CV] END colsample_bytree=1.0, learning_rate=0.2, max_depth=7, n_estimators=500,
reg_alpha=0, reg_lambda=1, subsample=1.0; total time= 1.3s
[CV] END colsample_bytree=1.0, learning_rate=0.2, max_depth=3, n_estimators=500,
reg_alpha=0.1, reg_lambda=1, subsample=0.8; total time= 0.3s
[CV] END colsample_bytree=0.6, learning_rate=0.05, max_depth=3,
n_estimators=200, reg_alpha=0.1, reg_lambda=2, subsample=0.6; total time= 0.1s
[CV] END colsample_bytree=0.6, learning_rate=0.05, max_depth=3,
n_estimators=200, reg_alpha=0.1, reg_lambda=2, subsample=0.6; total time= 0.1s
[CV] END colsample_bytree=0.6, learning_rate=0.1, max_depth=7, n_estimators=100,
reg_alpha=0, reg_lambda=1, subsample=1.0; total time= 0.3s
[CV] END colsample_bytree=0.8, learning_rate=0.05, max_depth=10,
n_estimators=300, reg_alpha=1, reg_lambda=1, subsample=1.0; total time= 2.2s
[CV] END colsample_bytree=1.0, learning_rate=0.1, max_depth=10,
n_estimators=100, reg_alpha=0.1, reg_lambda=1.5, subsample=1.0; total time=
0.7s
[CV] END colsample_bytree=0.6, learning_rate=0.2, max_depth=7, n_estimators=100,
reg_alpha=0.1, reg_lambda=2, subsample=0.8; total time= 0.2s
[CV] END colsample_bytree=0.6, learning_rate=0.2, max_depth=7, n_estimators=100,
reg_alpha=0.1, reg_lambda=2, subsample=0.8; total time= 0.2s
[CV] END colsample_bytree=0.8, learning_rate=0.2, max_depth=5, n_estimators=300,
reg_alpha=0.1, reg_lambda=2, subsample=0.8; total time= 0.3s
[CV] END colsample_bytree=1.0, learning_rate=0.01, max_depth=3,
n_estimators=500, reg_alpha=1, reg_lambda=1, subsample=0.8; total time= 0.3s
[CV] END colsample_bytree=1.0, learning_rate=0.01, max_depth=3,
n_estimators=500, reg_alpha=1, reg_lambda=1, subsample=0.8; total time= 0.3s
[CV] END colsample_bytree=0.6, learning_rate=0.05, max_depth=5,
n_estimators=500, reg_alpha=1, reg_lambda=2, subsample=0.8; total time= 0.5s
[CV] END colsample_bytree=0.8, learning_rate=0.05, max_depth=7,
n_estimators=300, reg_alpha=0, reg_lambda=1.5, subsample=1.0; total time= 0.6s
[CV] END colsample_bytree=0.8, learning_rate=0.01, max_depth=10,
n_estimators=100, reg_alpha=0.1, reg_lambda=1, subsample=0.6; total time= 0.6s
[CV] END colsample_bytree=0.8, learning_rate=0.1, max_depth=7, n_estimators=100,
reg_alpha=0.1, reg_lambda=2, subsample=0.8; total time= 0.2s
[CV] END colsample_bytree=0.8, learning_rate=0.05, max_depth=10,
n_estimators=300, reg_alpha=1, reg_lambda=1, subsample=0.6; total time= 1.3s

```

```

[150]: param_grid = {
        'n_estimators': [100, 200, 300], # Number of trees

```

```

    'max_depth': [None, 10, 20, 30], # Maximum depth of each tree
    'min_samples_split': [2, 5, 10], # Minimum samples per split
    'min_samples_leaf': [1, 2, 4],   # Minimum samples per leaf node
    'max_features': ['auto', 'sqrt', 'log2'] # Number of features to consider
}

```

```

[151]: # Initialize the Random Forest Regressor
rf = RandomForestRegressor(random_state=42)

# Initialize GridSearchCV
grid_search = GridSearchCV(estimator=rf, param_grid=param_grid, cv=3,
    ↪scoring='neg_mean_squared_error', verbose=2, n_jobs=-1)

# Fit the grid search to the data

```

```

[152]: grid_search.fit(X_train, y_train)

```

```

Fitting 3 folds for each of 324 candidates, totalling 972 fits
[CV] END max_depth=None, max_features=auto, min_samples_leaf=1,
min_samples_split=2, n_estimators=100; total time= 0.0s
[CV] END max_depth=None, max_features=auto, min_samples_leaf=1,
min_samples_split=10, n_estimators=100; total time= 0.0s
[CV] END max_depth=None, max_features=auto, min_samples_leaf=1,
min_samples_split=10, n_estimators=200; total time= 0.0s
[CV] END max_depth=None, max_features=auto, min_samples_leaf=1,
min_samples_split=10, n_estimators=300; total time= 0.0s
[CV] END max_depth=None, max_features=auto, min_samples_leaf=1,
min_samples_split=10, n_estimators=300; total time= 0.0s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=300; total time= 4.6s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=300; total time= 4.5s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 1.3s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 1.4s
[CV] END max_depth=None, max_features=auto, min_samples_leaf=1,
min_samples_split=2, n_estimators=200; total time= 0.0s
[CV] END max_depth=None, max_features=auto, min_samples_leaf=1,
min_samples_split=10, n_estimators=100; total time= 0.0s
[CV] END max_depth=None, max_features=auto, min_samples_leaf=1,
min_samples_split=10, n_estimators=200; total time= 0.0s
[CV] END max_depth=None, max_features=auto, min_samples_leaf=1,
min_samples_split=10, n_estimators=200; total time= 0.0s
[CV] END max_depth=None, max_features=auto, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time= 0.0s
[CV] END max_depth=None, max_features=auto, min_samples_leaf=2,

```

[illegible]


```
min_samples_split=10, n_estimators=300; total time= 3.4s  
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,  
min_samples_split=10, n_estimators=300; total time= 3.6s  
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,  
min_samples_split=10, n_estimators=300; total time= 3.3s  
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,  
min_samples_split=2, n_estimators=100; total time= 1.1s  
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,  
min_samples_split=2, n_estimators=200; total time= 2.5s  
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,  
min_samples_split=2, n_estimators=200; total time= 2.6s  
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,  
min_samples_split=2, n_estimators=200; total time= 2.7s  
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,  
min_samples_split=2, n_estimators=300; total time= 4.0s  
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,  
min_samples_split=2, n_estimators=300; total time= 4.0s  
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,  
min_samples_split=2, n_estimators=300; total time= 4.1s  
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,  
min_samples_split=5, n_estimators=100; total time= 1.3s  
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,  
min_samples_split=5, n_estimators=100; total time= 1.3s  
[CV] END max_depth=None, max_features=auto, min_samples_leaf=1,  
min_samples_split=2, n_estimators=300; total time= 0.0s  
[CV] END max_depth=None, max_features=auto, min_samples_leaf=2,  
min_samples_split=2, n_estimators=200; total time= 0.0s  
[CV] END max_depth=None, max_features=auto, min_samples_leaf=2,  
min_samples_split=2, n_estimators=200; total time= 0.0s  
[CV] END max_depth=None, max_features=auto, min_samples_leaf=2,  
min_samples_split=2, n_estimators=300; total time= 0.0s  
[CV] END max_depth=None, max_features=auto, min_samples_leaf=2,  
min_samples_split=10, n_estimators=300; total time= 0.0s  
[CV] END max_depth=None, max_features=auto, min_samples_leaf=4,  
min_samples_split=2, n_estimators=100; total time= 0.0s  
[CV] END max_depth=None, max_features=auto, min_samples_leaf=4,  
min_samples_split=2, n_estimators=200; total time= 0.0s  
[CV] END max_depth=None, max_features=auto, min_samples_leaf=4,  
min_samples_split=2, n_estimators=300; total time= 0.0s  
[CV] END max_depth=None, max_features=auto, min_samples_leaf=4,  
min_samples_split=5, n_estimators=100; total time= 0.0s  
[CV] END max_depth=None, max_features=auto, min_samples_leaf=4,  
min_samples_split=5, n_estimators=200; total time= 0.0s  
[CV] END max_depth=None, max_features=auto, min_samples_leaf=4,  
min_samples_split=5, n_estimators=300; total time= 0.0s  
[CV] END max depth=None, max features=auto, min samples leaf=4,
```



```

min_samples_split=5, n_estimators=300; total time= 4.0s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time= 3.9s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time= 3.9s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time= 1.2s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=300; total time= 2.8s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=300; total time= 2.7s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=300; total time= 2.7s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=100; total time= 0.9s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=100; total time= 0.9s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=100; total time= 0.9s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=200; total time= 1.8s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=200; total time= 1.9s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=100; total time= 0.9s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=200; total time= 1.8s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=200; total time= 1.8s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=100; total time= 0.9s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=300; total time= 2.7s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=300; total time= 2.7s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=200; total time= 1.8s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=100; total time= 0.9s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=300; total time= 2.7s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=300; total time= 2.7s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=200; total time= 3.0s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=300; total time= 4.4s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,

```

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]


```

min_samples_split=2, n_estimators=200; total time= 2.3s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=200; total time= 2.5s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=300; total time= 3.6s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=300; total time= 3.4s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=200; total time= 2.0s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=200; total time= 1.9s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=200; total time= 1.9s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=300; total time= 2.8s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=200; total time= 1.8s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=200; total time= 1.7s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=200; total time= 1.8s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=300; total time= 2.6s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=100; total time= 1.0s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=200; total time= 1.8s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=100; total time= 0.9s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=300; total time= 2.7s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=300; total time= 2.7s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=200; total time= 1.8s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=200; total time= 1.8s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time= 0.9s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=300; total time= 2.7s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=300; total time= 2.7s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=100; total time= 0.9s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=300; total time= 2.8s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,

```

```

min_samples_split=10, n_estimators=300; total time= 3.6s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=300; total time= 3.5s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=100; total time= 1.3s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=100; total time= 1.3s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=200; total time= 2.4s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=200; total time= 2.3s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=300; total time= 3.5s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=300; total time= 3.4s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=300; total time= 3.4s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=100; total time= 1.1s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=100; total time= 1.3s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=100; total time= 1.1s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=200; total time= 2.6s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=300; total time= 3.8s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=300; total time= 3.7s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=300; total time= 4.0s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=100; total time= 1.2s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=100; total time= 1.2s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=100; total time= 1.2s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=200; total time= 2.5s
[CV] END max_depth=30, max_features=auto, min_samples_leaf=1,
min_samples_split=5, n_estimators=300; total time= 0.0s
[CV] END max_depth=30, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=100; total time= 1.5s
[CV] END max_depth=30, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=200; total time= 2.9s
[CV] END max_depth=30, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=300; total time= 4.5s
[CV] END max_depth=30, max_features=sqrt, min_samples_leaf=1,

```

```

min_samples_split=2, n_estimators=300; total time= 4.4s
[CV] END max_depth=30, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=300; total time= 4.6s
[CV] END max_depth=30, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 1.3s

```

```

[152]: GridSearchCV(cv=3, estimator=RandomForestRegressor(random_state=42), n_jobs=-1,
                  param_grid={'max_depth': [None, 10, 20, 30],
                              'max_features': ['auto', 'sqrt', 'log2'],
                              'min_samples_leaf': [1, 2, 4],
                              'min_samples_split': [2, 5, 10],
                              'n_estimators': [100, 200, 300]},
                  scoring='neg_mean_squared_error', verbose=2)

```

```

[153]: print("Best Parameters:", grid_search.best_params_)

```

```

Best Parameters: {'max_depth': None, 'max_features': 'sqrt', 'min_samples_leaf':
1, 'min_samples_split': 2, 'n_estimators': 300}

```

```

[154]: best_model_gs = grid_search.best_estimator_

```

```

[155]: # Predict on the test set
y_pred_grid = best_model_gs.predict(X_test)

```

```

[156]: rmse = mean_squared_error(y_test, y_pred_grid, squared=False)
mae = mean_absolute_error(y_test, y_pred_grid)
medae = median_absolute_error(y_test, y_pred_grid)
msle = mean_squared_log_error(y_test, y_pred_grid)
explained_var = explained_variance_score(y_test, y_pred_grid)
r2 = r2_score(y_test, y_pred_grid)
# Print metrics
print(f"Root Mean Squared Error (RMSE): {rmse}")
print(f"Mean Absolute Error (MAE): {mae}")
print(f"Median Absolute Error: {medae}")
print(f"Mean Squared Logarithmic Error (MSLE): {msle}")
print(f"Explained Variance Score: {explained_var}")
print(f"Explained R2 score: {r2}")

```

```

Root Mean Squared Error (RMSE): 3.123876624679251
Mean Absolute Error (MAE): 1.954177897574124
Median Absolute Error: 1.1833333333333333
Mean Squared Logarithmic Error (MSLE): 0.008379517942696623
Explained Variance Score: 0.9763110764223416
Explained R2 score: 0.9762966779383369

```

```

[186]: # Predict on the training data
y_train_pred = best_model_gs.predict(X_train)

```

```

# Calculate RMSE and R2 for training data
rmse_train = mean_squared_error(y_train, y_train_pred, squared=False)
r2_train = r2_score(y_train, y_train_pred)

print(f"Training RMSE: {rmse_train}")
print(f"Training R2: {r2_train}")

```

Training RMSE: 1.1613927831231885

Training R²: 0.9967491090894874

```

[187]: # Predict on the test data
y_test_pred = best_model_gs.predict(X_test)

# Calculate RMSE and R2 for test data
rmse_test = mean_squared_error(y_test, y_test_pred, squared=False)
r2_test = r2_score(y_test, y_test_pred)

print(f"Test RMSE: {rmse_test}")
print(f"Test R2: {r2_test}")

```

Test RMSE: 3.123876624679251

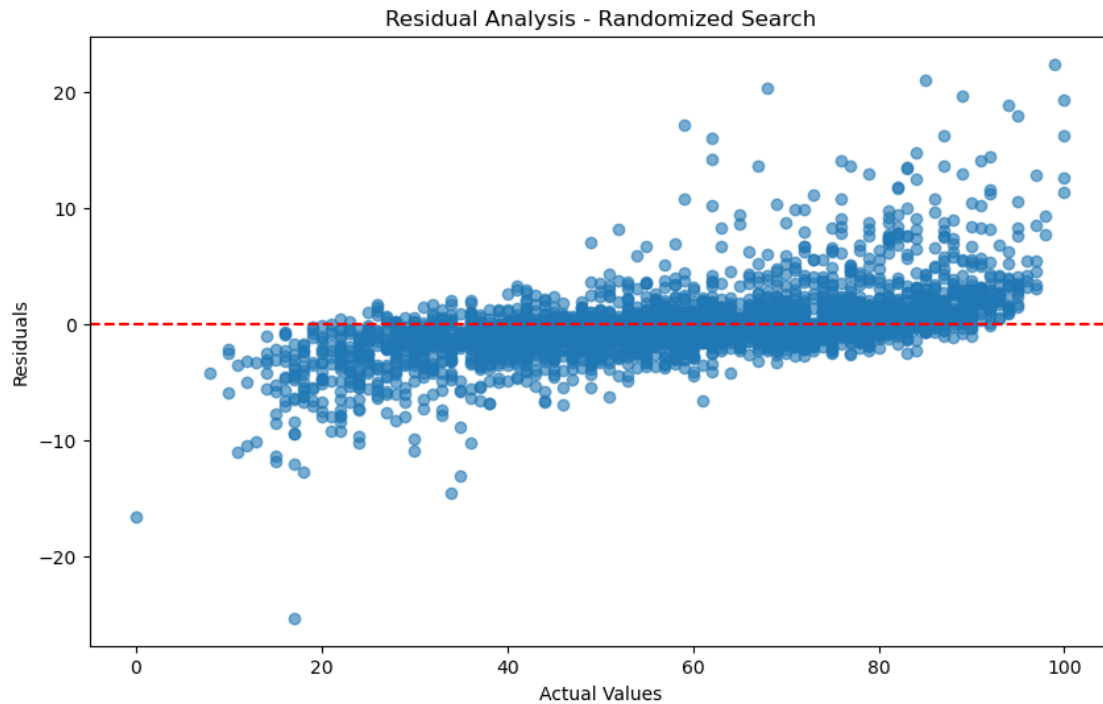
Test R²: 0.9762966779383369

```

[188]: residuals = y_test - best_model_gs.predict(X_test)

# Plot residuals
plt.figure(figsize=(10, 6))
plt.scatter(y_test, residuals, alpha=0.6)
plt.axhline(y=0, color='r', linestyle='--')
plt.xlabel('Actual Values')
plt.ylabel('Residuals')
plt.title('Residual Analysis - Randomized Search')
plt.show()

```



```
[158]: param_dist = {
    'n_estimators': [100, 200, 300, 500],
    'max_depth': [None, 10, 20, 30, 40],
    'min_samples_split': [2, 5, 10],
    'min_samples_leaf': [1, 2, 4],
    'max_features': ['auto', 'sqrt', 'log2'],
    'bootstrap': [True, False]
}

[159]: random_search = RandomizedSearchCV(
    estimator=rf,
    param_distributions=param_dist,
    n_iter=100, # Number of parameter settings sampled
    cv=3,
    scoring='neg_mean_squared_error',
    verbose=2,
    random_state=42,
    n_jobs=-1
)

[160]: random_search.fit(X_train, y_train)
```

Fitting 3 folds for each of 100 candidates, totalling 300 fits

```
[160]: RandomizedSearchCV(cv=3, estimator=RandomForestRegressor(random_state=42),
                        n_iter=100, n_jobs=-1,
                        param_distributions={'bootstrap': [True, False],
                                           'max_depth': [None, 10, 20, 30, 40],
                                           'max_features': ['auto', 'sqrt',
                                                           'log2'],
                                           'min_samples_leaf': [1, 2, 4],
                                           'min_samples_split': [2, 5, 10],
                                           'n_estimators': [100, 200, 300, 500]},
                        random_state=42, scoring='neg_mean_squared_error',
                        verbose=2)
```

```
[161]: print("Best Parameters:", random_search.best_params_)
```

```
Best Parameters: {'n_estimators': 300, 'min_samples_split': 2,
                  'min_samples_leaf': 1, 'max_features': 'sqrt', 'max_depth': None, 'bootstrap':
                  False}
```

```
[162]: best_model = random_search.best_estimator_
```

```
[163]: # Predict on the test set
y_pred_random = best_model.predict(X_test)

# Evaluate performanc
```

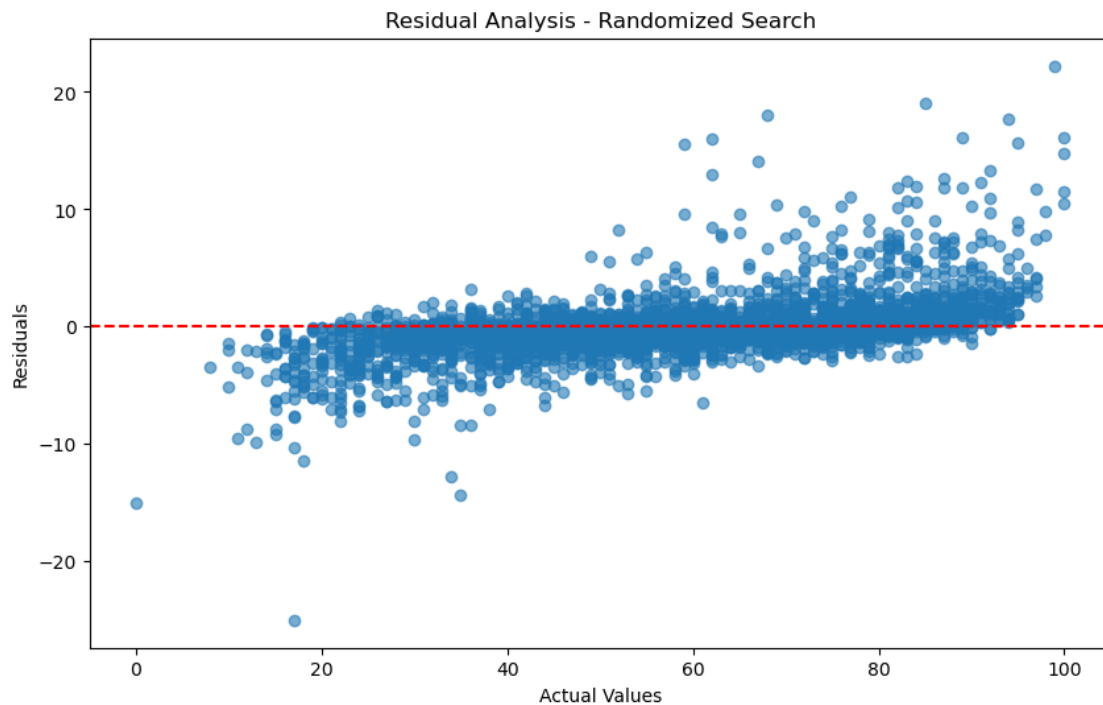
```
[164]: rmse = mean_squared_error(y_test, y_pred_random, squared=False)
mae = mean_absolute_error(y_test, y_pred_random)
medae = median_absolute_error(y_test, y_pred_random)
msle = mean_squared_log_error(y_test, y_pred_random)

# Print metrics
print(f"Root Mean Squared Error (RMSE): {rmse}")
print(f"Mean Absolute Error (MAE): {mae}")
print(f"Median Absolute Error: {medae}")
print(f"Mean Squared Logarithmic Error (MSLE): {msle}")
print(f"Explained Variance Score: {explained_var}")
print(f"Explained R2 score: {r2}")
```

```
Root Mean Squared Error (RMSE): 2.7098237422360563
Mean Absolute Error (MAE): 1.6553324348607368
Median Absolute Error: 1.0
Mean Squared Logarithmic Error (MSLE): 0.006711334168302773
Explained Variance Score: 0.9763110764223416
Explained R2 score: 0.9762966779383369
```

```
[165]: residuals = y_test - random_search.best_estimator_.predict(X_test)
```

```
# Plot residuals
plt.figure(figsize=(10, 6))
plt.scatter(y_test, residuals, alpha=0.6)
plt.axhline(y=0, color='r', linestyle='--')
plt.xlabel('Actual Values')
plt.ylabel('Residuals')
plt.title('Residual Analysis - Randomized Search')
plt.show()
```



```
[166]: cv_scores = cross_val_score(random_search.best_estimator_, X, y, cv=5,
    ↪scoring='neg_mean_squared_error')
rmse_cv = (-cv_scores.mean()) ** 0.5

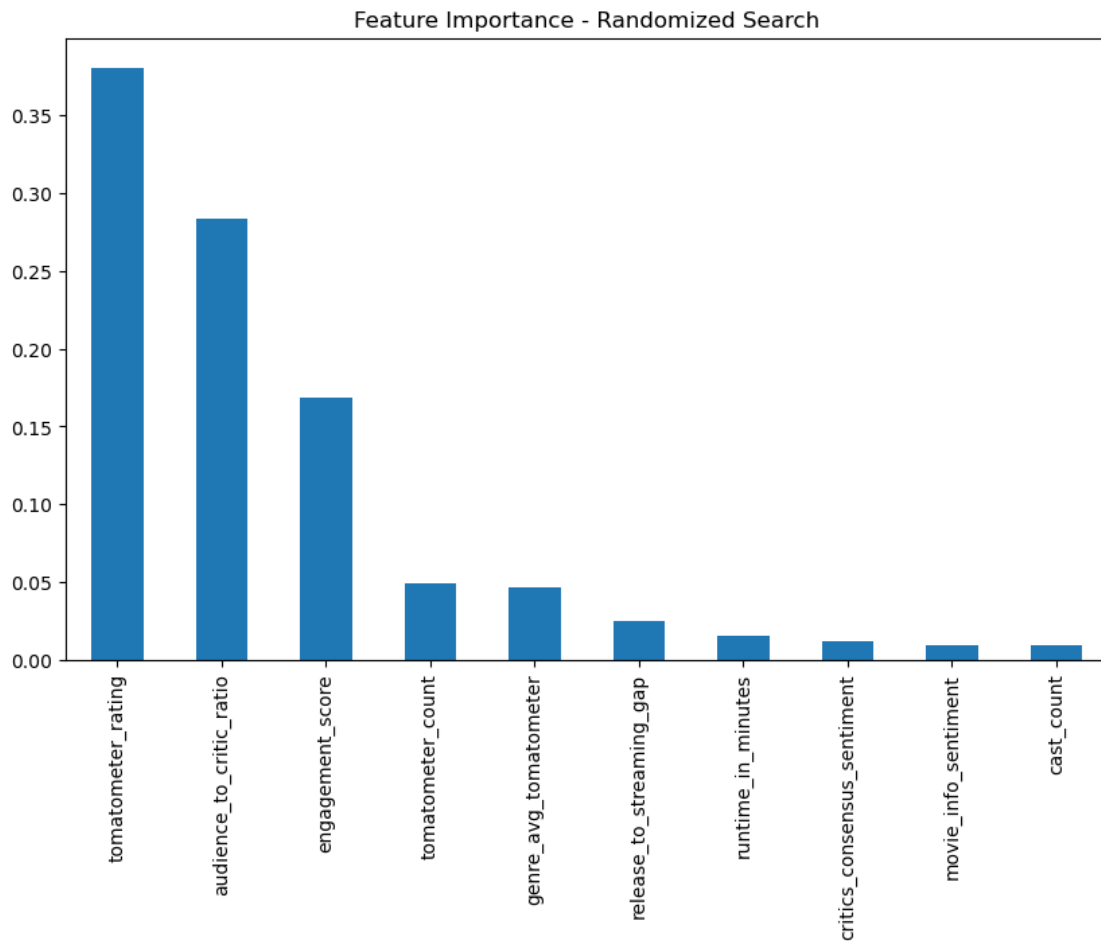
print(f"Cross-Validation RMSE (Randomized Search): {rmse_cv}")
```

Cross-Validation RMSE (Randomized Search): 2.6836512567460553

```
[195]: # Feature importance
feature_importance = pd.Series(random_search.best_estimator_.
    ↪feature_importances_, index=X.columns).sort_values(ascending=False)

# Plot
feature_importance.plot(kind='bar', figsize=(10, 6), title="Feature Importance_
    ↪ Randomized Search")
```

```
plt.show()
```



```
[168]: # Define features (X) and target (y)
X = df_final.drop(columns=['audience_rating'])
y = df_final['audience_rating']

# Split the data
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2,
↳ random_state=42)
```

```
[169]: xgb_model = XGBRegressor(random_state=42, eval_metric='rmse',
↳ use_label_encoder=False)
```

```
[170]: param_grid = {
    'n_estimators': [100, 200, 300, 500],
    'max_depth': [3, 5, 7, 10],
    'learning_rate': [0.01, 0.05, 0.1, 0.2],
```



```

    'subsample': [0.6, 0.8, 1.0],
    'colsample_bytree': [0.6, 0.8, 1.0],
    'reg_alpha': [0, 0.1, 1],
    'reg_lambda': [1, 1.5, 2],
}

```

```

[171]: random_search_xgb = RandomizedSearchCV(
    estimator=xgb_model,
    param_distributions=param_grid,
    n_iter=50,  # Number of random combinations to try
    scoring='neg_mean_squared_error',
    cv=3,
    verbose=2,
    random_state=42,
    n_jobs=-1
)

```

```

[181]: # Fit Randomized Search to the data
random_search_xgb.fit(X_train, y_train)

```

Fitting 3 folds for each of 50 candidates, totalling 150 fits

```

/Users/rithickchandranramesh/anaconda3/lib/python3.10/site-
packages/xgboost/core.py:158: UserWarning: [11:14:49] WARNING:
/Users/runner/work/xgboost/xgboost/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.

```

```

    warnings.warn(smsg, UserWarning)
/Users/rithickchandranramesh/anaconda3/lib/python3.10/site-
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/Users/runner/work/xgboost/xgboost/src/learner.cc:740:  
Parameters: { "use_label_encoder" } are not used.
```

```
warnings.warn(smsg, UserWarning)  
/Users/rithickchandranramesh/anaconda3/lib/python3.10/site-  
packages/xgboost/core.py:158: UserWarning: [11:14:58] WARNING:  
/Users/runner/work/xgboost/xgboost/src/learner.cc:740:  
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```
warnings.warn(smsg, UserWarning)  
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packages/xgboost/core.py:158: UserWarning: [11:14:59] WARNING:  
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Parameters: { "use_label_encoder" } are not used.
```

```
warnings.warn(smsg, UserWarning)
```

```
[181]: RandomizedSearchCV(cv=3,  
                        estimator=XGBRegressor(base_score=None, booster=None,  
                                              callbacks=None,  
                                              colsample_bylevel=None,  
                                              colsample_bynode=None,  
                                              colsample_bytree=None, device=None,  
                                              early_stopping_rounds=None,  
                                              enable_categorical=False,  
                                              eval_metric='rmse',  
                                              feature_types=None, gamma=None,  
                                              grow_policy=None,  
                                              importance_type=None,  
                                              interaction_constraints=None,  
                                              learning_rate=None,  
                                              n_estimators=None, n_jobs=None,  
                                              num_parallel_tree=None,  
                                              random_state=42, ...),  
                        n_iter=50, n_jobs=-1,  
                        param_distributions={'colsample_bytree': [0.6, 0.8, 1.0],  
                                           'learning_rate': [0.01, 0.05, 0.1, 0.2],  
                                           'max_depth': [3, 5, 7, 10],  
                                           'n_estimators': [100, 200, 300, 500],  
                                           'reg_alpha': [0, 0.1, 1],  
                                           'reg_lambda': [1, 1.5, 2],  
                                           'subsample': [0.6, 0.8, 1.0]},  
                        random_state=42, scoring='neg_mean_squared_error',  
                        verbose=2)
```

```
[173]: # Best parameters  
print("Best Parameters for XGBoost:", random_search_xgb.best_params_)
```

```
Best Parameters for XGBoost: {'subsample': 1.0, 'reg_lambda': 1.5, 'reg_alpha':  
0.1, 'n_estimators': 100, 'max_depth': 10, 'learning_rate': 0.1,  
'colsample_bytree': 1.0}
```

```
[174]: best_xgb_model = random_search_xgb.best_estimator_
```

```
[175]: y_pred_xgb = best_xgb_model.predict(X_test)
# Calculate metrics
```

```
[176]: rmse_xgb = mean_squared_error(y_test, y_pred_xgb, squared=False)
mae_xgb = mean_absolute_error(y_test, y_pred_xgb)
medae_xgb = median_absolute_error(y_test, y_pred_xgb)
msle_xgb = mean_squared_log_error(y_test, y_pred_xgb)
explained_var_xgb = explained_variance_score(y_test, y_pred_xgb)
r2_xgb = r2_score(y_test, y_pred_xgb)
print(f"Root Mean Squared Error (RMSE): {rmse_xgb}")
print(f"Mean Absolute Error (MAE): {mae_xgb}")
print(f"Median Absolute Error: {medae_xgb}")
print(f"Mean Squared Logarithmic Error (MSLE): {msle_xgb}")
print(f"Explained Variance Score: {explained_var_xgb}")
print(f"Explained R2 score: {r2_xgb}")
```

Root Mean Squared Error (RMSE): 1.2620356289204444
Mean Absolute Error (MAE): 0.45198188412864254
Median Absolute Error: 0.18026161193847656
Mean Squared Logarithmic Error (MSLE): 0.0038366902098003913
Explained Variance Score: 0.9961315768465502
Explained R² score: 0.9961313031292248

```
[197]: y_train_pred = random_search_xgb.predict(X_train)

# Calculate RMSE and R2 for training data
rmse_train = mean_squared_error(y_train, y_train_pred, squared=False)
r2_train = r2_score(y_train, y_train_pred)

print(f"Training RMSE: {rmse_train}")
print(f"Training R2: {r2_train}")
```

Training RMSE: 0.27086592777581664
Training R²: 0.9998231712376169

```
[198]: # Predict on the test data
y_test_pred = random_search_xgb.predict(X_test)

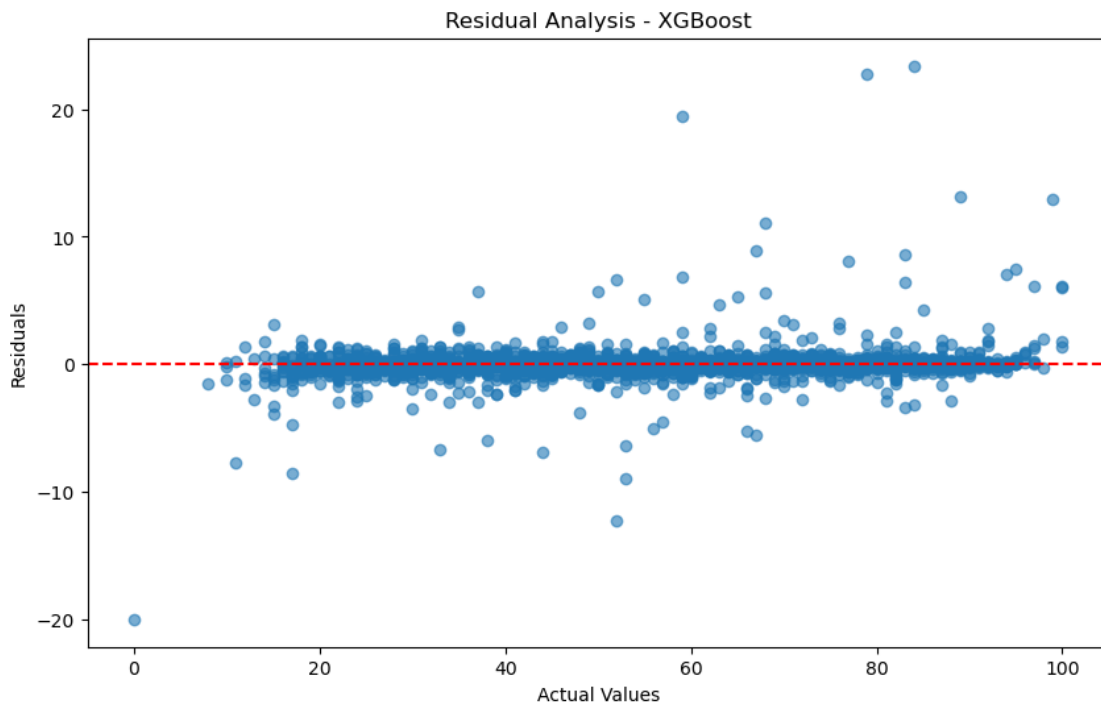
# Calculate RMSE and R2 for test data
rmse_test = mean_squared_error(y_test, y_test_pred, squared=False)
r2_test = r2_score(y_test, y_test_pred)

print(f"Test RMSE: {rmse_test}")
print(f"Test R2: {r2_test}")
```

Test RMSE: 1.2620356289204444
Test R²: 0.9961313031292248

```
[177]: residuals = y_test - y_pred_xgb

# Plot residuals
plt.figure(figsize=(10, 6))
plt.scatter(y_test, residuals, alpha=0.6)
plt.axhline(y=0, color='r', linestyle='--')
plt.xlabel('Actual Values')
plt.ylabel('Residuals')
plt.title('Residual Analysis - XGBoost')
plt.show()
```



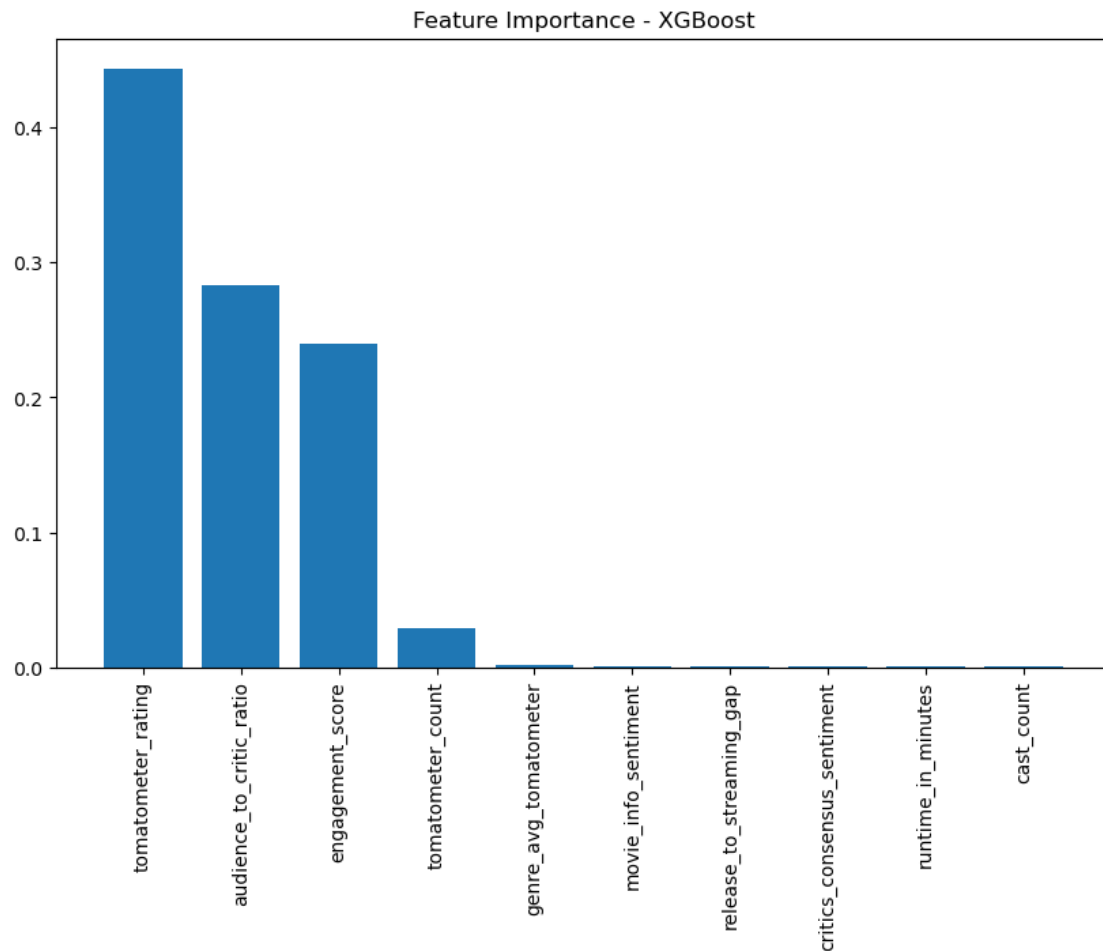
```
[178]: # Cross-validated RMSE for XGBoost
cv_scores_xgb = cross_val_score(best_xgb_model, X, y, cv=5,
    scoring='neg_mean_squared_error')
xgb_rmse_cv = (-cv_scores_xgb.mean()) ** 0.5

print(f"Cross-Validated RMSE (XGBoost): {xgb_rmse_cv}")
```

Cross-Validated RMSE (XGBoost): 1.050510980867686

```
[179]: # Plot feature importance
importances = best_xgb_model.feature_importances_
sorted_indices = importances.argsort()[::-1]
```

```
plt.figure(figsize=(10, 6))
plt.bar(X.columns[sorted_indices], importances[sorted_indices])
plt.xticks(rotation=90)
plt.title('Feature Importance - XGBoost')
plt.show()
```



[]: