

# 03\_random\_forest

November 20, 2025

## 1 Random Forest

### 1.0.1 Preparamos las features que nos interesan

```
[5]: from pathlib import Path
import numpy as np
import pandas as pd
from sklearn.model_selection import train_test_split, KFold
from sklearn.compose import ColumnTransformer
from sklearn.pipeline import Pipeline
from sklearn.metrics import f1_score
from sklearn.feature_extraction.text import TfidfVectorizer
from scipy.sparse import hstack
from vaderSentiment.vaderSentiment import SentimentIntensityAnalyzer

import json

DATA_DIR = Path('../data/nlp-getting-started')
TRAIN_PATH = DATA_DIR / 'train.csv'
TEST_PATH = DATA_DIR / 'test.csv'
LOCATION_TO_COUNTRY_PATH = Path('../data/location_to_country.json')
RANDOM_SEED = 27

train_df = pd.read_csv(TRAIN_PATH)
test_df = pd.read_csv(TEST_PATH)

with open(LOCATION_TO_COUNTRY_PATH, 'r', encoding='utf-8') as f:
    location_to_country = json.load(f)

# Categóricas: 'country', 'keyword'. Después las voy a mean encodear.
train_df['country'] = train_df['location'].map(location_to_country).
    fillna('unknown')
test_df['country'] = test_df['location'].map(location_to_country).
    fillna('unknown')

train_df['keyword'] = train_df['keyword'].fillna('missing')
test_df['keyword'] = test_df['keyword'].fillna('missing')
```

```

categorical_features = ['country', 'keyword']

# Numéricas: 'text_length', 'num_hashtags', 'num_mentions', ↴
↳ 'num_uppercase_per_word', 'sentiment_score', 'has_url'

# one hot encoding de 'has_url' a mano
train_df['has_url'] = train_df['text'].fillna('').str.contains(r'http[s]?://', ↴
    regex=True).astype(int)
test_df['has_url'] = test_df['text'].fillna('').str.contains(r'http[s]?://', ↴
    regex=True).astype(int)

train_df['text_length'] = train_df['text'].fillna('').str.len()
test_df['text_length'] = test_df['text'].fillna('').str.len()

train_df['num_hashtags'] = train_df['text'].str.count('#')
train_df['num_mentions'] = train_df['text'].str.count('@')

test_df['num_hashtags'] = test_df['text'].str.count('#')
test_df['num_mentions'] = test_df['text'].str.count('@')

def uppercase_per_word(text):
    text = str(text)

    # Palabras que tengan al menos una letra alfabética
    words = [w for w in text.split() if any(ch.isalpha() for ch in w)]
    if not words:
        return 0.0

    # Solo letras alfabéticas, para evitar que cuenten símbolos raros
    uppercase_letters = sum(ch.isupper() for ch in text if ch.isalpha())
    return uppercase_letters / len(words)

train_df['num_uppercase_per_word'] = train_df['text'].apply(uppercase_per_word)
test_df['num_uppercase_per_word'] = test_df['text'].apply(uppercase_per_word)

analyzer = SentimentIntensityAnalyzer()

def get_sentiment(text):
    if pd.isna(text) or text.strip() == '':
        return 0.5
    compound = analyzer.polarity_scores(text)['compound']
    return (compound + 1) / 2

train_df['sentiment_score'] = train_df['text'].apply(get_sentiment)
test_df['sentiment_score'] = test_df['text'].apply(get_sentiment)

```

```

numeric_features = ['text_length', 'num_hashtags', 'num_mentions', ↵
    ↵'num_uppercase_per_word', 'sentiment_score', 'has_url']

embedding_feature = 'text'

# 1. Separar features y target
X = train_df[numeric_features + categorical_features + [embedding_feature]].
    ↵copy()
y = train_df['target'].copy()

# 2. Split estratificado train/validation (80/20)
X_train, X_val, y_train, y_val = train_test_split(
    X, y, test_size=0.2, random_state=RANDOM_SEED, stratify=y
)

X_train.head()

```

```

[5]:      text_length  num_hashtags  num_mentions  num_uppercase_per_word \
2721          87           1           0           1.000000
2259         132           0           0           0.083333
1815         136           0           0           1.333333
682          139           0           0           1.666667
7216         121           0           2           0.210526

      sentiment_score  has_url           country  keyword \
2721        0.18755       1      unknown  devastated
2259        0.55135       0      unknown  deluged
1815        0.27205       1  United Kingdom  crashed
682         0.50000       1      unknown  blazing
7216        0.78595       0  United States  weapons

                           text
2721  Obama declares disaster for typhoon-devastated...
2259  Businesses are deluged with invzices. Make you...
1815  Neil_Eastwood77: I AM A KNOBHEAD!! Bin Laden f...
682   Morgan Silver Dollar 1880 S Gem BU DMPL Cameo ...
7216  @danagould @WaynestesterAtl I agree with backgrou...

```

### 1.0.2 Oki vamos a hacer encoding de las features categóricas.

```

[3]: from sklearn.model_selection import KFold

def kfold_target_encoding(train_series, target_series, n_splits=5, ↵
    ↵random_state=RANDOM_SEED):
    encoded = pd.Series(np.nan, index=train_series.index, dtype=float)
    kf = KFold(n_splits=n_splits, shuffle=True, random_state=random_state)

```

```

global_mean = target_series.mean()

for train_idx, val_idx in kf.split(train_series):
    fold_df = pd.DataFrame({
        'feature': train_series.iloc[train_idx],
        'target': target_series.iloc[train_idx]
    })
    means = fold_df.groupby('feature')['target'].mean()
    encoded.iloc[val_idx] = train_series.iloc[val_idx].map(means)

encoded.fillna(global_mean, inplace=True)

full_df = pd.DataFrame({'feature': train_series, 'target': target_series})
mapping = full_df.groupby('feature')['target'].mean()

return encoded, mapping, global_mean

mean_encoded_features = []

for column in ['country', 'keyword']:
    train_encoded, mapping, global_mean = kfold_target_encoding(
        X_train[column], y_train
    )
    encoded_col = f'{column}_target_mean'
    # agrego columnas nuevas a los splits
    X_train[encoded_col] = train_encoded
    X_val[encoded_col] = X_val[column].map(mapping).fillna(global_mean)
    test_df[encoded_col] = test_df[column].map(mapping).fillna(global_mean)

    mean_encoded_features.append(encoded_col)

numeric_features = numeric_features + mean_encoded_features

X_train[numeric_features].head()

X_train_numeric = X_train[numeric_features].to_numpy()
X_val_numeric = X_val[numeric_features].to_numpy()
X_test_numeric = test_df[numeric_features].to_numpy()

```

Genial, ya tenemos todas las features listas para el random forest. Me gustaría igual hacer un embedding del texto y reducirlo a pocas features, quizás le agregue al modelo...

```
[ ]: from sklearn.decomposition import TruncatedSVD
N_COMPONENTS = 30 # Voy a tener que jugar un poco con este hiperparámetro
```

```

# Transformer para texto (TF-IDF)
tfidf_vectorizer = TfidfVectorizer(
    max_features=5000,
    ngram_range=(1, 2),
    min_df=2,
    max_df=0.95,
    strip_accents='unicode',
    lowercase=True,
    analyzer='word',
    token_pattern=r'\w{1,}',
    stop_words='english'
)

X_train_text = tfidf_vectorizer.fit_transform(X_train[embedding_feature] .
    ↪fillna(''))
X_val_text = tfidf_vectorizer.transform(X_val[embedding_feature].fillna(''))
X_test_text = tfidf_vectorizer.transform(test_df[embedding_feature].fillna(''))

print(f"\nTF-IDF vectorizer:")
print(f"  Vocabulary size: {len(tfidf_vectorizer.vocabulary_)}")
print(f"  Feature names (first 10): {tfidf_vectorizer.get_feature_names_out()[::
    ↪10].tolist()}")

# SVD para reducir dimensionalidad del TF-IDF
svd = TruncatedSVD(
    n_components=N_COMPONENTS,
    random_state=RANDOM_SEED
)

X_train_text_15 = svd.fit_transform(X_train_text)
X_val_text_15 = svd.transform(X_val_text)
X_test_text_15 = svd.transform(X_test_text)

X_train_combined = np.hstack([X_train_numeric, X_train_text_15])
X_val_combined = np.hstack([X_val_numeric, X_val_text_15])
X_test_combined = np.hstack([X_test_numeric, X_test_text_15])

print(f"  Test shape: {X_test_combined.shape}")

pd.DataFrame(X_train_combined).head()

```

TF-IDF vectorizer:  
 Vocabulary size: 5000  
 Feature names (first 10): ['0', '00', '00 http', '00 pm', '000', '01', '01  
 04', '02', '03', '04']  
 Test shape: (3263, 23)

```
[ ]:      0    1    2    3    4    5    6    7    8  \
0  87.0  1.0  0.0  1.000000  0.18755  1.0  0.415596  0.500000  0.130693
1 132.0  0.0  0.0  0.083333  0.55135  0.0  0.415596  0.357143  0.006938
2 136.0  0.0  0.0  1.333333  0.27205  1.0  0.367647  0.666667  0.145825
3 139.0  0.0  0.0  1.666667  0.50000  1.0  0.420105  0.000000  0.226158
4 121.0  0.0  2.0  0.210526  0.78595  0.0  0.428266  0.440000  0.017488

         9    ...    13    14    15    16    17    18  \
0 -0.023246  ...  0.047581  0.032348 -0.023974 -0.005268 -0.085837 -0.130308
1  0.004381  ... -0.016803  0.001901 -0.001933 -0.004619  0.003743 -0.011423
2 -0.009459  ... -0.002862 -0.005137 -0.006146 -0.034278  0.018311  0.003717
3 -0.021648  ... -0.042221  0.005437 -0.020891 -0.042579  0.035766 -0.020977
4  0.026917  ...  0.038122 -0.058757  0.021060  0.003295 -0.077684  0.156654

        19    20    21    22
0  0.297432 -0.048629  0.426707 -0.115991
1  0.003899 -0.009453  0.006504 -0.004439
2 -0.028955 -0.003576 -0.002582 -0.053259
3 -0.044987  0.008722 -0.005189 -0.056172
4 -0.025329  0.006817  0.016986 -0.033469

[5 rows x 23 columns]
```

Bueno me cierra. A ver cómo sale el modelo con estas features.

## 2 RandomForest

### 2.1 Hiper-parámetros

- n\_estimators: cantidad de árboles a construir (100)
- max\_depth: máxima profundidad de cada árbol
- min\_samples\_split: cantidad mínima de datos requeridos para splitear un nodo interno (2)
- min\_samples\_leaf: cantidad mínima de datos requeridos para ser una hoja (1)
- max\_features: cantidad de features a considerar cuando se busca el mejor split (n)

```
[8]: from sklearn.ensemble import RandomForestClassifier
from sklearn.model_selection import GridSearchCV
from sklearn.metrics import f1_score

# Modelo base
rf_base = RandomForestClassifier(
    random_state=RANDOM_SEED,
    n_jobs=-1,
    class_weight='balanced_subsample'
)
```

```

# Grid de hiper-parámetros
param_grid = {
    'n_estimators': [100, 300, 500],
    'max_depth': [None, 10, 20],
    'min_samples_split': [2, 5, 10],
    'min_samples_leaf': [1, 2, 4],
    'max_features': ['sqrt', 'log2']
}

grid_search = GridSearchCV(
    estimator=rf_base,
    param_grid=param_grid,
    scoring='f1',
    cv=3,
    n_jobs=-1,
    verbose=2
)

grid_search.fit(X_train_combined, y_train)

print("Mejores hiper-parámetros encontrados:")
print(grid_search.best_params_)

best_rf = grid_search.best_estimator_

y_val_pred = best_rf.predict(X_val_combined)
f1_val = f1_score(y_val, y_val_pred)
print(f"F1 en validation: {f1_val:.4f}")

```

Fitting 3 folds for each of 162 candidates, totalling 486 fits

[CV] END max\_depth=None, max\_features=sqrt, min\_samples\_leaf=1, min\_samples\_split=2, n\_estimators=100; total time= 1.2s

[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=sqrt, min\_samples\_leaf=1, min\_samples\_split=2, n\_estimators=100; total time= 1.5s

[CV] END max\_depth=None, max\_features=sqrt, min\_samples\_leaf=1, min\_samples\_split=2, n\_estimators=100; total time= 1.6s

[CV] END max\_depth=None, max\_features=sqrt, min\_samples\_leaf=1, min\_samples\_split=5, n\_estimators=100; total time= 1.7s

[CV] END max\_depth=None, max\_features=sqrt, min\_samples\_leaf=1, min\_samples\_split=10, n\_estimators=100; total time= 2.5s

[CV] END max\_depth=None, max\_features=sqrt, min\_samples\_leaf=1, min\_samples\_split=2, n\_estimators=300; total time= 4.2s

[CV] END max\_depth=None, max\_features=sqrt, min\_samples\_leaf=1, min\_samples\_split=10, n\_estimators=100; total time= 2.5s



```
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=500; total time= 8.0s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=300; total time= 5.4s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time= 1.8s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=300; total time= 5.8s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time= 2.4s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time= 4.6s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=500; total time= 8.7s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time= 5.4s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=500; total time= 7.6s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time= 5.9s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=100; total time= 1.8s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=500; total time= 8.1s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=100; total time= 2.1s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=100; total time= 2.0s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=300; total time= 4.3s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=500; total time= 9.1s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=300; total time= 4.4s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=300; total time= 4.6s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=500; total time= 8.2s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=500; total time= 8.5s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=100; total time= 1.6s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=100; total time= 1.8s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=100; total time= 1.6s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=500; total time= 9.0s
```

```
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=300; total time= 4.2s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=300; total time= 4.5s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=300; total time= 5.1s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=100; total time= 1.9s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=500; total time= 7.6s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=500; total time= 8.5s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=100; total time= 1.7s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=100; total time= 1.9s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=300; total time= 4.6s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=500; total time= 8.6s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=300; total time= 4.2s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=500; total time= 7.4s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=100; total time= 1.8s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=100; total time= 1.8s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=500; total time= 7.7s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=100; total time= 1.8s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=300; total time= 5.4s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=500; total time= 7.7s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=300; total time= 5.1s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=300; total time= 4.9s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=300; total time= 5.2s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 1.9s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=500; total time= 8.0s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=500; total time= 8.2s
```

```

[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=500; total time= 8.2s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 1.8s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 1.9s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=500; total time= 6.4s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=500; total time= 6.8s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=300; total time= 4.9s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=100; total time= 1.3s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=300; total time= 5.3s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=300; total time= 5.3s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=500; total time= 7.3s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=100; total time= 1.4s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=100; total time= 1.8s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=300; total time= 4.0s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=500; total time= 6.9s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
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=500; total time= 7.6s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=300; total time= 5.5s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=300; total time= 4.8s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
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=10, n_estimators=300; total time= 3.6s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=100; total time= 1.6s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=500; total time= 8.7s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=500; total time= 5.5s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=300; total time= 4.7s

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[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=500; total time= 7.2s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=300; total time= 3.0s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=300; total time= 5.6s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=100; total time= 2.1s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=100; total time= 2.1s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=100; total time= 1.8s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=300; total time= 3.4s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=500; total time= 8.3s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time= 1.9s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time= 1.9s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=300; total time= 5.4s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time= 1.7s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=500; total time= 8.4s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=500; total time= 8.2s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=500; total time= 7.9s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=500; total time= 6.0s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
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=2, n_estimators=500; total time= 6.6s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time= 4.6s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=100; total time= 1.5s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=500; total time= 6.9s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=100; total time= 1.8s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=100; total time= 2.0s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time= 5.6s

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[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=300; total time= 3.6s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
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=5, n_estimators=500; total time= 6.2s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=500; total time= 6.2s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=300; total time= 4.3s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=100; total time= 1.9s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=500; total time= 7.5s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=100; total time= 2.1s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=100; total time= 1.9s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=300; total time= 4.2s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=300; total time= 4.9s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=300; total time= 4.6s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=100; total time= 1.7s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=500; total time= 7.0s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=500; total time= 7.5s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=100; total time= 1.7s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=500; total time= 5.7s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=300; total time= 4.4s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=100; total time= 1.9s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=300; total time= 4.7s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=500; total time= 8.6s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=300; total time= 5.3s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=500; total time= 7.2s
[CV] END max_depth=10, max_features=sqrt, 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=4,
min_samples_split=2, n_estimators=500; total time= 7.5s
[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=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=100; total time= 1.7s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=100; total time= 1.9s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=500; total time= 5.1s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=300; total time= 4.4s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 1.8s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 1.9s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=300; total time= 4.9s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 2.3s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=500; total time= 7.7s[CV] END max_depth=10,
max_features=sqrt, min_samples_leaf=1, min_samples_split=2, n_estimators=300;
total time= 3.2s

[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=500; total time= 7.9s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=300; total time= 4.2s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=300; total time= 5.2s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=100; total time= 1.7s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=500; total time= 6.9s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=100; total time= 2.0s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, 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=300; total time= 3.3s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=500; total time= 7.8s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=500; total time= 7.8s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=100; total time= 2.5s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,

```

```
min_samples_split=2, n_estimators=500; total time= 6.3s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=100; total time= 1.2s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=300; total time= 5.2s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=500; total time= 7.1s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=100; total time= 1.8s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=500; total time= 7.1s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=100; total time= 1.8s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=300; total time= 3.3s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=300; total time= 3.3s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=100; total time= 1.9s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=100; total time= 1.9s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=100; total time= 2.0s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=300; total time= 6.0s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=500; total time= 8.3s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=500; total time= 5.6s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=500; total time= 7.7s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=500; total time= 8.0s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=300; total time= 4.9s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=300; total time= 4.1s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=300; total time= 4.8s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=500; total time= 7.3s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time= 1.6s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time= 1.9s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=500; total time= 7.4s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
```

```
min_samples_split=10, n_estimators=100; total time= 1.9s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time= 3.1s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=500; total time= 6.4s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=500; total time= 6.6s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=100; total time= 1.3s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=100; total time= 1.3s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time= 4.8s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=500; total time= 7.7s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time= 5.1s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=300; total time= 3.9s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=300; total time= 4.0s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=100; total time= 2.1s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=100; total time= 1.9s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=100; 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= 5.0s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=300; total time= 3.3s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=500; total time= 7.1s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=100; total time= 2.0s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=500; total time= 7.6s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=500; total time= 7.3s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=300; total time= 4.3s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=300; total time= 5.2s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=500; total time= 6.5s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=500; total time= 6.6s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
```

```

min_samples_split=10, n_estimators=100; total time= 1.7s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=100; total time= 1.8s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=500; total time= 7.7s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=100; total time= 1.6s
[CV] END max_depth=10, max_features=sqrt, 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=4,
min_samples_split=5, n_estimators=300; total time= 3.5s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=300; total time= 3.8s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=500; total time= 6.9s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=100; total time= 1.5s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=100; total time= 1.6s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=500; total time= 7.4s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=500; total time= 7.3s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=100; total time= 1.8s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=300; total time= 3.7s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=300; total time= 4.0s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=300; total time= 3.9s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=500; total time= 5.9s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 1.7s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 1.8s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=500; total time= 6.9s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=500; total time= 7.0s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 1.8s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=300; total time= 4.0s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=300; total time= 4.7s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,

```

```

min_samples_split=2, n_estimators=300; total time= 4.0s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=500; total time= 6.7s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=100; total time= 1.6s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=100; total time= 1.3s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=500; total time= 6.6s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=500; total time= 7.4s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=300; total time= 3.8s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=100; total time= 1.5s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=300; total time= 4.4s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=500; total time= 6.1s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=300; total time= 4.1s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=500; total time= 6.5s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=100; total time= 1.2s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=100; total time= 1.4s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=100; total time= 1.5s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=500; total time= 6.9s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=300; total time= 3.6s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=300; total time= 3.6s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=300; total time= 4.5s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=100; total time= 1.5s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=500; total time= 6.3s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=500; total time= 6.1s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=500; total time= 6.3s
[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,

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min_samples_split=5, n_estimators=100; total time= 1.4s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=500; total time= 4.5s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=300; total time= 3.9s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=300; total time= 4.1s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time= 1.6s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=300; total time= 4.9s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time= 2.1s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=500; total time= 7.0s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time= 1.8s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time= 3.5s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=500; total time= 7.0s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=500; total time= 5.2s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time= 3.8s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=500; total time= 5.6s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=500; total time= 6.1s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time= 4.2s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=2, 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=100; total time= 1.5s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=100; total time= 1.8s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=500; total time= 5.1s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=300; total time= 3.9s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=500; total time= 5.6s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=300; total time= 4.1s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=500; total time= 6.2s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,

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min_samples_split=5, n_estimators=100; total time= 1.5s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=100; total time= 1.3s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=300; total time= 4.2s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=100; total time= 1.7s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=300; total time= 3.5s
[CV] END max_depth=10, 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=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=300; total time= 4.4s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=300; total time= 2.8s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=100; total time= 1.6s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=100; total time= 1.6s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=500; total time= 6.1s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=500; total time= 6.0s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=100; total time= 1.8s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=500; total time= 6.0s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=300; total time= 3.5s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=500; total time= 5.7s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=300; total time= 3.7s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=500; total time= 5.6s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=500; total time= 5.6s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=100; total time= 1.7s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=100; total time= 1.7s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=500; total time= 4.8s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=100; total time= 2.1s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=300; total time= 3.9s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,

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min_samples_split=5, n_estimators=500; total time= 5.8s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=300; total time= 3.7s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=300; total time= 4.3s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=500; total time= 6.7s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 2.0s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 2.1s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=500; total time= 4.9s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 2.3s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=300; total time= 4.7s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=300; total time= 4.7s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=300; total time= 4.8s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=100; total time= 2.4s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=500; total time= 7.5s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=100; total time= 2.5s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=500; total time= 7.7s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=100; total time= 2.2s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=300; total time= 4.1s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=500; total time= 7.9s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=100; total time= 1.8s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=300; total time= 6.2s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=300; total time= 6.4s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=100; total time= 2.0s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=500; total time= 8.6s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=300; total time= 4.8s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,

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min_samples_split=10, n_estimators=300; total time= 4.9s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=100; total time= 1.9s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=500; total time= 9.4s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=500; total time= 7.3s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=100; total time= 1.9s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=500; total time= 8.3s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=300; total time= 5.5s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=100; total time= 2.1s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=100; total time= 2.1s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=500; total time= 6.1s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=500; total time= 9.3s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=500; total time= 7.4s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=300; total time= 5.8s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=300; total time= 5.9s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time= 2.2s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time= 1.6s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=300; total time= 5.9s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=500; total time= 9.0s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time= 2.0s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time= 4.5s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time= 5.3s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=500; total time= 7.9s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time= 5.7s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=100; total time= 1.6s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,

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min_samples_split=2, n_estimators=500; total time= 9.0s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=500; total time= 8.4s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=100; total time= 2.3s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=100; total time= 2.1s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=300; total time= 4.8s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=500; total time= 7.4s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=300; total time= 4.6s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=500; total time= 8.2s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=300; total time= 6.1s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=100; total time= 2.2s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=100; total time= 1.7s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=100; total time= 2.0s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=300; total time= 4.3s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=500; total time= 9.8s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=300; total time= 5.1s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=500; total time= 8.0s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=100; total time= 1.9s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=300; total time= 5.9s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=500; total time= 8.9s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=500; total time= 5.9s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=100; total time= 2.2s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=500; total time= 8.6s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=100; total time= 2.2s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=300; total time= 5.4s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,

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```

min_samples_split=5, n_estimators=300; total time= 4.4s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=500; total time= 7.6s
[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=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=300; total time= 5.8s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=500; total time= 8.8s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=100; total time= 2.2s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=500; total time= 6.4s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=300; total time= 4.4s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=300; total time= 3.9s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=500; total time= 6.3s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=300; total time= 4.7s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 1.5s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 1.4s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=500; total time= 8.0s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 1.9s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=300; total time= 4.5s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=300; total time= 5.2s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=500; total time= 7.3s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=100; total time= 2.3s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=100; total time= 2.0s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=300; total time= 5.7s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=300; total time= 4.3s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=500; total time= 8.0s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,

```

```

min_samples_split=10, n_estimators=500; total time= 8.3s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=300; total time= 5.0s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=300; total time= 4.2s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=100; total time= 1.6s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=500; total time= 7.1s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=500; total time= 5.4s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=500; total time= 7.7s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=100; total time= 1.7s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=100; total time= 1.8s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=100; total time= 1.9s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=500; total time= 5.9s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=300; total time= 4.4s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=300; total time= 4.0s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=300; total time= 4.1s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=500; total time= 9.0s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=100; total time= 1.4s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=100; total time= 1.6s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=500; total time= 8.0s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=100; total time= 1.6s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=300; total time= 4.8s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=500; total time= 6.2s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=300; total time= 4.9s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=500; total time= 6.8s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=300; total time= 5.0s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,

```

```

min_samples_split=10, n_estimators=100; total time= 1.9s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=500; total time= 5.2s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time= 1.3s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time= 4.1s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time= 2.2s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time= 4.3s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=500; total time= 8.3s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=500; total time= 6.3s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time= 5.5s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=100; total time= 1.5s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=100; total time= 1.7s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=100; total time= 1.8s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=300; total time= 4.0s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=500; total time= 8.4s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=500; total time= 6.8s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=300; total time= 4.4s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=300; total time= 5.0s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=100; total time= 1.5s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=100; total time= 1.3s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=100; total time= 1.4s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=500; total time= 5.1s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=500; total time= 7.8s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=500; total time= 8.0s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=500; total time= 5.2s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,

```

```

min_samples_split=2, n_estimators=300; total time= 4.1s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=300; total time= 4.8s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=100; total time= 1.6s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=300; total time= 4.9s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=500; total time= 6.6s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=100; total time= 1.5s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=100; total time= 1.7s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=300; total time= 3.9s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=500; total time= 5.6s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=300; total time= 3.8s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=300; total time= 4.6s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=300; total time= 3.4s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=500; total time= 7.2s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=500; total time= 7.3s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=300; total time= 3.2s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=500; total time= 5.1s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=300; total time= 4.2s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=500; total time= 5.2s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=500; total time= 5.4s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=500; total time= 3.7s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=500; total time= 4.0s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=500; total time= 3.9s
Mejores hiper-parámetros encontrados:
{'max_depth': 20, 'max_features': 'sqrt', 'min_samples_leaf': 4,
'min_samples_split': 10, 'n_estimators': 500}
F1 en validation: 0.7560

```

Jajaja bastante peor que mi regresión lineal. Vamos a ver de cambiar las features del embedding de texto, reducirlas a más dimensiones quizás ayude.

Update! Esta corrida fue la mejor. Todas las demás fueron peores. Voy a probar con otro modelo en el próximo notebook.

```
[9]: from pathlib import Path

submissions_dir = Path('../resultados')
submissions_dir.mkdir(parents=True, exist_ok=True)
baseline_submit_path = submissions_dir / 'random_forest_baseline.csv'

y_test_pred = best_rf.predict(X_test_combined)

submission = pd.DataFrame({
    'id': test_df['id'],
    'target': y_test_pred
})

# Guardar CSV
submission.to_csv(baseline_submit_path, index=False)
```

```
[ ]: from sklearn.decomposition import TruncatedSVD
N_COMPONENTS = 100 # Cambié esto a 100 para ver si mejora

# Transformer para texto (TF-IDF)
tfidf_vectorizer = TfidfVectorizer(
    max_features=5000,
    ngram_range=(1, 2),
    min_df=2,
    max_df=0.95,
    strip_accents='unicode',
    lowercase=True,
    analyzer='word',
    token_pattern=r'\w{1,}',
    stop_words='english'
)

X_train_text = tfidf_vectorizer.fit_transform(X_train[embedding_feature] .
    ↪fillna(''))
X_val_text = tfidf_vectorizer.transform(X_val[embedding_feature].fillna(''))
X_test_text = tfidf_vectorizer.transform(test_df[embedding_feature].fillna(''))

print(f"\nTF-IDF vectorizer:")
print(f"  Vocabulary size: {len(tfidf_vectorizer.vocabulary_)}")
print(f"  Feature names (first 10): {tfidf_vectorizer.get_feature_names_out()[:10].tolist()}")
```

```

svd = TruncatedSVD(
    n_components=N_COMPONENTS,
    random_state=RANDOM_SEED
)

X_train_text_15 = svd.fit_transform(X_train_text)
X_val_text_15   = svd.transform(X_val_text)
X_test_text_15  = svd.transform(X_test_text)

X_train_combined = np.hstack([X_train_numeric, X_train_text_15])
X_val_combined   = np.hstack([X_val_numeric,   X_val_text_15])
X_test_combined  = np.hstack([X_test_numeric,  X_test_text_15])

print(f" Test shape: {X_test_combined.shape}")

pd.DataFrame(X_train_combined).head()

```

```

[ ]: from sklearn.ensemble import RandomForestClassifier
from sklearn.model_selection import GridSearchCV
from sklearn.metrics import f1_score

# Modelo base
rf_base = RandomForestClassifier(
    random_state=RANDOM_SEED,
    n_jobs=-1,
    class_weight='balanced_subsample'
)

# Grid de hiper-parámetros
param_grid = {
    'n_estimators': [100, 300, 500],
    'max_depth': [None, 10, 20],
    'min_samples_split': [2, 5, 10],
    'min_samples_leaf': [1, 2, 4],
    'max_features': ['sqrt', 'log2']
}

grid_search = GridSearchCV(
    estimator=rf_base,
    param_grid=param_grid,
    scoring='f1',
    cv=3,
    n_jobs=-1,
    verbose=2
)

```

```

grid_search.fit(X_train_combined, y_train)

print("Mejores hiper-parámetros encontrados:")
print(grid_search.best_params_)

best_rf = grid_search.best_estimator_

y_val_pred = best_rf.predict(X_val_combined)
f1_val = f1_score(y_val, y_val_pred)
print(f"F1 en validation: {f1_val:.4f}")

```

Fitting 3 folds for each of 162 candidates, totalling 486 fits

[CV] END max\_depth=None, max\_features=sqrt, min\_samples\_leaf=1, min\_samples\_split=5, n\_estimators=100; total time= 2.2s

[CV] END max\_depth=None, max\_features=sqrt, min\_samples\_leaf=1, min\_samples\_split=2, n\_estimators=100; total time= 2.7s

[CV] END max\_depth=None, max\_features=sqrt, min\_samples\_leaf=1, min\_samples\_split=5, n\_estimators=100; total time= 2.8s

[CV] END max\_depth=None, max\_features=sqrt, min\_samples\_leaf=1, min\_samples\_split=2, n\_estimators=100; total time= 3.6s

[CV] END max\_depth=None, max\_features=sqrt, min\_samples\_leaf=1, min\_samples\_split=2, n\_estimators=100; total time= 3.7s

[CV] END max\_depth=None, max\_features=sqrt, min\_samples\_leaf=1, min\_samples\_split=5, n\_estimators=100; total time= 3.9s

[CV] END max\_depth=None, max\_features=sqrt, min\_samples\_leaf=1, min\_samples\_split=10, n\_estimators=100; total time= 3.6s

[CV] END max\_depth=None, max\_features=sqrt, min\_samples\_leaf=1, min\_samples\_split=10, n\_estimators=100; total time= 4.2s

[CV] END max\_depth=None, max\_features=sqrt, min\_samples\_leaf=1, min\_samples\_split=10, n\_estimators=100; total time= 4.5s

[CV] END max\_depth=None, max\_features=sqrt, min\_samples\_leaf=1, min\_samples\_split=5, n\_estimators=300; total time= 8.2s

[CV] END max\_depth=None, max\_features=sqrt, min\_samples\_leaf=1, min\_samples\_split=5, n\_estimators=300; total time= 8.6s

[CV] END max\_depth=None, max\_features=sqrt, min\_samples\_leaf=1, min\_samples\_split=2, n\_estimators=300; total time= 8.6s

[CV] END max\_depth=None, max\_features=sqrt, min\_samples\_leaf=1, min\_samples\_split=5, n\_estimators=300; total time= 10.0s

[CV] END max\_depth=None, max\_features=sqrt, min\_samples\_leaf=1, min\_samples\_split=2, n\_estimators=300; total time= 10.1s

[CV] END max\_depth=None, max\_features=sqrt, min\_samples\_leaf=1, min\_samples\_split=2, n\_estimators=300; total time= 10.4s

[CV] END max\_depth=None, max\_features=sqrt, min\_samples\_leaf=2, min\_samples\_split=2, n\_estimators=100; total time= 4.1s

[CV] END max\_depth=None, max\_features=sqrt, min\_samples\_leaf=2, min\_samples\_split=2, n\_estimators=100; total time= 3.0s

[CV] END max\_depth=None, max\_features=sqrt, min\_samples\_leaf=2,

```

min_samples_split=2, n_estimators=100; total time= 3.2s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=300; total time= 9.7s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=500; total time= 14.3s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=500; total time= 15.0s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=500; total time= 12.8s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=500; total time= 15.2s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=500; total time= 15.6s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=300; total time= 10.0s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=100; total time= 2.8s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=500; total time= 15.4s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=100; total time= 3.3s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=300; total time= 10.6s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=100; total time= 3.6s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=300; total time= 9.7s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=300; total time= 8.8s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=500; total time= 14.1s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time= 4.0s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=500; total time= 15.0s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=500; total time= 15.1s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=300; total time= 10.8s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time= 3.6s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time= 3.1s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time= 10.0s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time= 9.5s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,

```

```

min_samples_split=5, n_estimators=300; total time= 9.0s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=100; total time= 3.1s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=500; total time= 14.7s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=100; total time= 2.9s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=500; total time= 16.0s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=100; total time= 4.0s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=500; total time= 15.9s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=300; total time= 7.7s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=500; total time= 13.1s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=500; total time= 13.9s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=300; total time= 9.7s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=300; total time= 9.1s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=100; total time= 3.2s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=500; total time= 15.5s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=100; total time= 3.6s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=100; total time= 2.6s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=300; total time= 7.3s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=300; total time= 7.7s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=300; total time= 9.0s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=100; total time= 3.9s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=500; total time= 15.2s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=500; total time= 15.5s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=100; total time= 3.6s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=500; total time= 15.9s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,

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min_samples_split=2, n_estimators=500; total time= 10.8s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=100; total time= 3.9s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=300; total time= 7.9s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=300; total time= 9.2s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=100; total time= 2.5s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=300; total time= 10.1s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=100; total time= 2.7s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=500; total time= 13.2s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=500; total time= 12.7s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=100; total time= 2.7s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=300; total time= 8.7s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 2.9s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=300; total time= 8.5s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=500; total time= 13.0s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=300; total time= 9.2s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 3.1s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=500; total time= 14.4s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=300; total time= 5.9s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 2.5s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=300; total time= 6.5s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=300; total time= 6.9s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=500; total time= 15.9s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=100; total time= 2.5s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=100; total time= 2.6s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,

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min_samples_split=10, n_estimators=100; total time= 2.7s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=500; total time= 12.3s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=500; total time= 12.6s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=500; total time= 9.9s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=300; total time= 5.7s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=500; total time= 10.5s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=500; total time= 14.0s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=500; total time= 11.6s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=100; total time= 2.1s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=300; total time= 7.1s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=300; total time= 7.7s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=100; total time= 1.8s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=500; total time= 7.9s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=100; total time= 3.1s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=300; total time= 5.5s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=300; total time= 7.4s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=100; total time= 2.2s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=500; total time= 10.4s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=300; total time= 4.9s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=100; total time= 2.4s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=300; total time= 7.5s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=500; total time= 11.0s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=100; total time= 2.3s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=300; total time= 5.1s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,

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min_samples_split=10, n_estimators=500; total time=  8.1s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=300; total time=  5.7s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=500; total time=  8.9s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time=  2.2s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time=  2.2s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time=  2.3s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=500; total time= 10.4s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time=  5.2s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=500; total time=  9.0s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time=  7.0s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=500; total time= 10.2s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=100; total time=  2.7s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=100; total time=  2.1s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time=  6.8s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=500; total time= 10.7s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=100; total time=  1.7s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=300; total time=  5.9s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=300; total time=  6.5s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=500; total time=  7.8s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=300; total time=  5.9s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=100; total time=  2.0s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=500; total time=  9.5s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=100; total time=  2.2s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=100; total time=  2.3s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,

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min_samples_split=5, n_estimators=500; total time= 10.0s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=500; total time= 8.9s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=300; total time= 6.1s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=500; total time= 8.7s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=300; total time= 6.1s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=300; total time= 6.1s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=100; total time= 2.4s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=500; total time= 11.1s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=100; total time= 2.3s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=100; total time= 2.6s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=300; total time= 6.5s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=300; total time= 6.9s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=300; total time= 5.7s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=500; total time= 8.7s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=500; total time= 8.8s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=500; total time= 6.2s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=300; total time= 4.2s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=100; total time= 2.5s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=100; total time= 2.2s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=500; total time= 10.1s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=500; total time= 8.1s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=100; total time= 3.3s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=300; total time= 5.9s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=300; total time= 6.5s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,

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min_samples_split=5, n_estimators=100; total time= 1.9s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 2.8s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=500; total time= 10.5s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 3.0s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=500; total time= 8.8s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=300; total time= 6.6s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=300; total time= 7.1s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=500; total time= 8.7s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=300; total time= 7.7s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=500; total time= 10.0s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=100; total time= 3.3s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=300; total time= 6.2s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=100; total time= 3.0s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=100; total time= 2.8s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=300; total time= 7.3s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=300; total time= 8.3s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=100; total time= 3.0s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=500; total time= 12.0s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=100; total time= 2.9s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=100; total time= 2.5s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=500; total time= 13.6s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=300; total time= 7.1s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=500; total time= 11.5s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=300; total time= 8.3s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,

```

```

min_samples_split=2, n_estimators=500; total time= 13.8s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=500; total time= 11.1s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=300; total time= 8.0s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=500; total time= 13.4s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=100; total time= 3.3s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=100; total time= 3.1s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=100; total time= 3.2s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=300; total time= 6.5s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=300; total time= 7.0s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=300; total time= 8.3s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time= 5.1s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=500; total time= 12.0s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=500; total time= 12.3s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=500; total time= 12.6s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time= 3.1s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time= 3.2s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time= 3.2s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time= 7.5s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time= 8.1s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=500; total time= 12.3s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=100; total time= 3.1s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=100; total time= 3.1s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=100; total time= 2.8s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=500; total time= 13.5s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,

```

```

min_samples_split=2, n_estimators=500; total time= 13.6s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=300; total time= 7.6s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=300; total time= 7.8s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=300; total time= 7.8s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=500; total time= 11.4s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=300; total time= 5.9s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=500; total time= 12.5s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=100; total time= 2.9s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=100; total time= 3.2s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=100; total time= 3.1s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=500; total time= 13.3s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=500; total time= 10.1s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=300; total time= 8.1s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=300; total time= 7.4s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=500; total time= 11.5s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=500; total time= 12.4s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=100; total time= 3.0s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=100; 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= 3.1s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=500; total time= 10.5s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=100; total time= 1.9s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=300; total time= 8.3s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=500; total time= 12.3s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=500; total time= 11.8s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,

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min_samples_split=2, n_estimators=100; total time= 2.0s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=300; total time= 8.9s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=100; total time= 2.9s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=300; total time= 6.8s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=300; total time= 9.4s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=300; total time= 8.4s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=300; total time= 7.8s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=500; total time= 10.9s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 2.4s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 2.1s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 2.2s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=300; total time= 5.0s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=300; total time= 5.5s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=500; total time= 11.5s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=300; total time= 5.7s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=500; total time= 12.8s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=100; 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= 2.5s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=300; total time= 4.9s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=500; total time= 11.4s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=500; total time= 11.1s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=500; total time= 11.4s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=100; total time= 2.2s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=300; total time= 4.7s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,

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min_samples_split=2, n_estimators=500; total time= 8.3s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=500; total time= 9.0s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=100; total time= 1.8s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=100; total time= 2.0s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=300; total time= 6.0s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=500; total time= 8.7s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=300; total time= 4.8s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=300; total time= 4.4s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=100; total time= 2.5s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=500; total time= 7.8s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=500; total time= 8.0s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=500; total time= 8.0s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=300; total time= 5.6s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=100; total time= 2.2s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=100; total time= 1.9s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=300; total time= 3.8s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=300; total time= 4.4s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=100; total time= 2.5s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=300; total time= 4.6s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=500; total time= 7.7s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=500; total time= 7.6s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=500; total time= 8.2s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time= 2.0s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time= 2.1s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,

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min_samples_split=10, n_estimators=100; total time= 2.0s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time= 3.9s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=500; total time= 7.2s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=100; total time= 2.0s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time= 5.7s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=500; total time= 7.6s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time= 6.0s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=100; total time= 2.3s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=500; total time= 6.6s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=100; total time= 2.2s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=300; total time= 5.2s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=300; total time= 4.6s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=500; total time= 9.6s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=300; total time= 5.9s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=100; total time= 1.6s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=100; 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= 2.2s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=500; total time= 8.8s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=500; total time= 9.1s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=300; total time= 4.5s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=500; total time= 7.0s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=300; total time= 5.0s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=300; total time= 5.4s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=500; total time= 7.7s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,

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min_samples_split=10, n_estimators=100; 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= 2.0s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=500; total time= 8.9s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=100; total time= 2.3s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=300; total time= 5.0s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=300; total time= 4.3s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=300; total time= 4.6s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=500; total time= 7.7s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=500; total time= 7.5s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=300; total time= 4.0s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=500; total time= 7.9s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=100; 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= 4.1s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=100; total time= 3.1s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=100; total time= 2.7s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=300; total time= 5.5s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=500; total time= 7.6s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=500; total time= 8.6s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 3.2s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=500; total time= 9.4s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 3.1s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 3.7s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=500; total time= 8.0s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=500; total time= 9.0s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,

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min_samples_split=10, n_estimators=500; total time=  9.3s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=300; total time=  9.8s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=100; total time=  4.4s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=300; total time= 10.6s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=100; total time=  3.9s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=300; total time= 10.2s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=100; total time=  4.3s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=300; total time=  9.7s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=500; total time= 12.0s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=300; total time=  9.2s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=300; total time= 10.5s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=100; total time=  3.4s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=500; total time= 13.5s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=500; total time= 14.8s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=100; total time=  3.4s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=100; total time=  4.6s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=300; total time=  9.6s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=300; total time=  7.6s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=500; total time= 14.5s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=300; total time=  9.6s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=500; total time= 15.2s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=100; total time=  3.3s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=100; total time=  3.1s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=100; total time=  3.3s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
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min_samples_split=5, n_estimators=500; total time= 16.1s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=300; total time= 8.4s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=300; total time= 8.2s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=300; total time= 10.3s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time= 3.1s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time= 3.1s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=500; total time= 16.1s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time= 4.5s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=500; total time= 17.2s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=500; total time= 17.2s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time= 9.2s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=500; total time= 12.9s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time= 10.1s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time= 10.6s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=500; total time= 14.6s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=300; total time= 7.4s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=100; total time= 3.7s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=500; total time= 17.0s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=100; total time= 3.6s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=300; total time= 7.6s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=100; total time= 2.4s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=500; total time= 13.3s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=100; total time= 2.7s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=300; total time= 10.0s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,

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min_samples_split=5, n_estimators=100; total time= 3.9s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=100; total time= 3.9s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=500; total time= 17.2s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=500; total time= 17.6s
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min_samples_split=2, n_estimators=300; total time= 7.8s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=300; total time= 8.6s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=300; total time= 8.8s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=300; total time= 7.5s
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min_samples_split=10, n_estimators=100; total time= 3.7s
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min_samples_split=10, n_estimators=500; total time= 15.4s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
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min_samples_split=10, n_estimators=500; total time= 16.7s
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min_samples_split=5, n_estimators=300; total time= 9.7s
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min_samples_split=2, n_estimators=100; total time= 2.4s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=100; total time= 2.7s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=100; total time= 3.0s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=500; total time= 14.5s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=500; total time= 16.2s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=300; total time= 7.2s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=300; total time= 7.9s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,

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min_samples_split=10, n_estimators=300; total time= 10.3s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
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[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=300; total time= 7.0s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=300; total time= 6.3s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
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[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
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[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
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[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
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min_samples_split=10, n_estimators=100; total time= 2.3s
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min_samples_split=2, n_estimators=500; total time= 10.7s
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min_samples_split=5, n_estimators=300; total time= 6.0s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=300; total time= 6.0s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=300; total time= 7.0s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=100; total time= 2.3s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=500; total time= 11.9s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
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[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=100; total time= 1.9s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,

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min_samples_split=2, n_estimators=500; total time= 12.3s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
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[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=300; total time= 7.1s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=300; total time= 7.5s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=100; total time= 2.1s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=500; total time= 10.2s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=100; total time= 2.2s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
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min_samples_split=5, n_estimators=500; total time= 10.6s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=100; total time= 2.2s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=500; total time= 8.7s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=500; total time= 8.5s
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[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
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[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
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[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time= 2.0s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time= 2.3s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time= 4.6s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time= 5.0s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time= 5.9s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
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[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=100; total time= 2.4s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,

```

```
min_samples_split=2, n_estimators=500; total time= 10.8s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=100; total time= 2.7s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
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[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=500; total time= 10.8s
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[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
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[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=100; total time= 2.4s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=100; total time= 2.5s
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min_samples_split=5, n_estimators=500; total time= 10.2s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=300; total time= 5.7s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=500; total time= 11.2s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=300; total time= 4.7s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=300; total time= 6.0s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=500; total time= 9.6s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=500; total time= 9.7s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=100; total time= 1.8s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=100; total time= 2.9s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=500; total time= 11.4s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=100; total time= 3.1s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=300; total time= 6.8s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=300; total time= 6.8s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
```

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min_samples_split=2, n_estimators=500; total time= 9.1s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=300; total time= 6.4s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=10, 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= 4.5s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
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[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=500; total time= 9.4s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=300; total time= 5.0s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=500; total time= 7.5s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=500; total time= 7.7s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=500; total time= 7.6s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=500; total time= 6.0s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=500; total time= 4.6s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=500; total time= 4.4s
Mejores hiper-parámetros encontrados:
{'max_depth': 10, 'max_features': 'sqrt', 'min_samples_leaf': 4,
'min_samples_split': 2, 'n_estimators': 500}
F1 en validation: 0.7379

```

Mucho peor. Overfitting a full. Voy a probar con otra lib en el embedding de texto. Entiendo que esta no capta contexto así que capaz con BERT anda mejor?

```
[44]: # ! pip install sentence-transformers
# ! pip install tf_keras

from sentence_transformers import SentenceTransformer

bert_model = SentenceTransformer('all-MiniLM-L6-v2') # 384 dims

def encode_texts(text_series):
    texts = text_series.fillna(' ').tolist()
    embeddings = bert_model.encode(
        texts,
        batch_size=32,
        show_progress_bar=True
    )
    return np.array(embeddings)
```

```

# Embeddings BERT para train / val / test
X_train_text_bert = encode_texts(X_train[embedding_feature])
X_val_text_bert = encode_texts(X_val[embedding_feature])
X_test_text_bert = encode_texts(test_df[embedding_feature])

print("Shapes BERT:")
print(" Train:", X_train_text_bert.shape)
print(" Val: ", X_val_text_bert.shape)
print(" Test: ", X_test_text_bert.shape)

X_train_combined = np.hstack([X_train_numeric, X_train_text_bert])
X_val_combined = np.hstack([X_val_numeric, X_val_text_bert])
X_test_combined = np.hstack([X_test_numeric, X_test_text_bert])

```

Collecting tf\_keras

  Downloading tf\_keras-2.20.1-py3-none-any.whl.metadata (1.8 kB)

Requirement already satisfied: tensorflow<2.21,>=2.20 in  
   /home/mate/FIUBA/ciencia-de-datos/tweet-checker/.venv/lib/python3.12/site-packages (from tf\_keras) (2.20.0)

Requirement already satisfied: absl-py>=1.0.0 in /home/mate/FIUBA/ciencia-de-datos/tweet-checker/.venv/lib/python3.12/site-packages (from tensorflow<2.21,>=2.20->tf\_keras) (2.3.1)

Requirement already satisfied: astunparse>=1.6.0 in /home/mate/FIUBA/ciencia-de-datos/tweet-checker/.venv/lib/python3.12/site-packages (from tensorflow<2.21,>=2.20->tf\_keras) (1.6.3)

Requirement already satisfied: flatbuffers>=24.3.25 in /home/mate/FIUBA/ciencia-de-datos/tweet-checker/.venv/lib/python3.12/site-packages (from tensorflow<2.21,>=2.20->tf\_keras) (25.9.23)

Requirement already satisfied: gast!=0.5.0,!0.5.1,!0.5.2,>=0.2.1 in  
   /home/mate/FIUBA/ciencia-de-datos/tweet-checker/.venv/lib/python3.12/site-packages (from tensorflow<2.21,>=2.20->tf\_keras) (0.6.0)

Requirement already satisfied: google\_pasta>=0.1.1 in /home/mate/FIUBA/ciencia-de-datos/tweet-checker/.venv/lib/python3.12/site-packages (from tensorflow<2.21,>=2.20->tf\_keras) (0.2.0)

Requirement already satisfied: libclang>=13.0.0 in /home/mate/FIUBA/ciencia-de-datos/tweet-checker/.venv/lib/python3.12/site-packages (from tensorflow<2.21,>=2.20->tf\_keras) (18.1.1)

Requirement already satisfied: opt\_einsum>=2.3.2 in /home/mate/FIUBA/ciencia-de-datos/tweet-checker/.venv/lib/python3.12/site-packages (from tensorflow<2.21,>=2.20->tf\_keras) (3.4.0)

Requirement already satisfied: packaging in /home/mate/FIUBA/ciencia-de-datos/tweet-checker/.venv/lib/python3.12/site-packages (from tensorflow<2.21,>=2.20->tf\_keras) (25.0)

Requirement already satisfied: protobuf>=5.28.0 in /home/mate/FIUBA/ciencia-de-datos/tweet-checker/.venv/lib/python3.12/site-packages (from tensorflow<2.21,>=2.20->tf\_keras) (6.33.1)

```
Requirement already satisfied: requests<3,>=2.21.0 in /home/mate/FIUBA/ciencia-de-datos/tweet-checker/.venv/lib/python3.12/site-packages (from tensorflow<2.21,>=2.20->tf_keras) (2.32.5)
Requirement already satisfied: setuptools in /home/mate/FIUBA/ciencia-de-datos/tweet-checker/.venv/lib/python3.12/site-packages (from tensorflow<2.21,>=2.20->tf_keras) (80.9.0)
Requirement already satisfied: six>=1.12.0 in /home/mate/FIUBA/ciencia-de-datos/tweet-checker/.venv/lib/python3.12/site-packages (from tensorflow<2.21,>=2.20->tf_keras) (1.17.0)
Requirement already satisfied: termcolor>=1.1.0 in /home/mate/FIUBA/ciencia-de-datos/tweet-checker/.venv/lib/python3.12/site-packages (from tensorflow<2.21,>=2.20->tf_keras) (3.2.0)
Requirement already satisfied: typing_extensions>=3.6.6 in /home/mate/FIUBA/ciencia-de-datos/tweet-checker/.venv/lib/python3.12/site-packages (from tensorflow<2.21,>=2.20->tf_keras) (4.15.0)
Requirement already satisfied: wrapt>=1.11.0 in /home/mate/FIUBA/ciencia-de-datos/tweet-checker/.venv/lib/python3.12/site-packages (from tensorflow<2.21,>=2.20->tf_keras) (2.0.1)
Requirement already satisfied: grpcio<2.0,>=1.24.3 in /home/mate/FIUBA/ciencia-de-datos/tweet-checker/.venv/lib/python3.12/site-packages (from tensorflow<2.21,>=2.20->tf_keras) (1.76.0)
Requirement already satisfied: tensorboard~=2.20.0 in /home/mate/FIUBA/ciencia-de-datos/tweet-checker/.venv/lib/python3.12/site-packages (from tensorflow<2.21,>=2.20->tf_keras) (2.20.0)
Requirement already satisfied: keras>=3.10.0 in /home/mate/FIUBA/ciencia-de-datos/tweet-checker/.venv/lib/python3.12/site-packages (from tensorflow<2.21,>=2.20->tf_keras) (3.12.0)
Requirement already satisfied: numpy>=1.26.0 in /home/mate/FIUBA/ciencia-de-datos/tweet-checker/.venv/lib/python3.12/site-packages (from tensorflow<2.21,>=2.20->tf_keras) (2.3.5)
Requirement already satisfied: h5py>=3.11.0 in /home/mate/FIUBA/ciencia-de-datos/tweet-checker/.venv/lib/python3.12/site-packages (from tensorflow<2.21,>=2.20->tf_keras) (3.15.1)
Requirement already satisfied: ml_dtypes<1.0.0,>=0.5.1 in /home/mate/FIUBA/ciencia-de-datos/tweet-checker/.venv/lib/python3.12/site-packages (from tensorflow<2.21,>=2.20->tf_keras) (0.5.3)
Requirement already satisfied: charset_normalizer<4,>=2 in /home/mate/FIUBA/ciencia-de-datos/tweet-checker/.venv/lib/python3.12/site-packages (from requests<3,>=2.21.0->tensorflow<2.21,>=2.20->tf_keras) (3.4.4)
Requirement already satisfied: idna<4,>=2.5 in /home/mate/FIUBA/ciencia-de-datos/tweet-checker/.venv/lib/python3.12/site-packages (from requests<3,>=2.21.0->tensorflow<2.21,>=2.20->tf_keras) (3.11)
Requirement already satisfied: urllib3<3,>=1.21.1 in /home/mate/FIUBA/ciencia-de-datos/tweet-checker/.venv/lib/python3.12/site-packages (from requests<3,>=2.21.0->tensorflow<2.21,>=2.20->tf_keras) (2.5.0)
Requirement already satisfied: certifi>=2017.4.17 in /home/mate/FIUBA/ciencia-de-datos/tweet-checker/.venv/lib/python3.12/site-packages (from requests<3,>=2.21.0->tensorflow<2.21,>=2.20->tf_keras) (2025.11.12)
```

```

Requirement already satisfied: markdown>=2.6.8 in /home/mate/FIUBA/ciencia-de-
datos/tweet-checker/.venv/lib/python3.12/site-packages (from
tensorboard~=2.20.0->tensorflow<2.21,>=2.20->tf_keras) (3.10)
Requirement already satisfied: pillow in /home/mate/FIUBA/ciencia-de-
datos/tweet-checker/.venv/lib/python3.12/site-packages (from
tensorboard~=2.20.0->tensorflow<2.21,>=2.20->tf_keras) (12.0.0)
Requirement already satisfied: tensorflow-data-server<0.8.0,>=0.7.0 in
/home/mate/FIUBA/ciencia-de-datos/tweet-checker/.venv/lib/python3.12/site-
packages (from tensorflow~=2.20.0->tensorflow<2.21,>=2.20->tf_keras) (0.7.2)
Requirement already satisfied: werkzeug>=1.0.1 in /home/mate/FIUBA/ciencia-de-
datos/tweet-checker/.venv/lib/python3.12/site-packages (from
tensorflow~=2.20.0->tensorflow<2.21,>=2.20->tf_keras) (3.1.3)
Requirement already satisfied: wheel<1.0,>=0.23.0 in /home/mate/FIUBA/ciencia-
de-datos/tweet-checker/.venv/lib/python3.12/site-packages (from
astunparse>=1.6.0->tensorflow<2.21,>=2.20->tf_keras) (0.45.1)
Requirement already satisfied: rich in /home/mate/FIUBA/ciencia-de-datos/tweet-
checker/.venv/lib/python3.12/site-packages (from
keras>=3.10.0->tensorflow<2.21,>=2.20->tf_keras) (14.2.0)
Requirement already satisfied: namex in /home/mate/FIUBA/ciencia-de-datos/tweet-
checker/.venv/lib/python3.12/site-packages (from
keras>=3.10.0->tensorflow<2.21,>=2.20->tf_keras) (0.1.0)
Requirement already satisfied: optree in /home/mate/FIUBA/ciencia-de-
datos/tweet-checker/.venv/lib/python3.12/site-packages (from
keras>=3.10.0->tensorflow<2.21,>=2.20->tf_keras) (0.18.0)
Requirement already satisfied: MarkupSafe>=2.1.1 in /home/mate/FIUBA/ciencia-de-
datos/tweet-checker/.venv/lib/python3.12/site-packages (from
werkzeug>=1.0.1->tensorflow~=2.20.0->tensorflow<2.21,>=2.20->tf_keras) (3.0.3)
Requirement already satisfied: markdown-it-py>=2.2.0 in
/home/mate/FIUBA/ciencia-de-datos/tweet-checker/.venv/lib/python3.12/site-
packages (from rich->keras>=3.10.0->tensorflow<2.21,>=2.20->tf_keras) (4.0.0)
Requirement already satisfied: pygments<3.0.0,>=2.13.0 in
/home/mate/FIUBA/ciencia-de-datos/tweet-checker/.venv/lib/python3.12/site-
packages (from rich->keras>=3.10.0->tensorflow<2.21,>=2.20->tf_keras) (2.19.2)
Requirement already satisfied: mdurl~=0.1 in /home/mate/FIUBA/ciencia-de-
datos/tweet-checker/.venv/lib/python3.12/site-packages (from markdown-it-
py>=2.2.0->rich->keras>=3.10.0->tensorflow<2.21,>=2.20->tf_keras) (0.1.2)
Downloading tf_keras-2.20.1-py3-none-any.whl (1.7 MB)
    1.7/1.7 MB
30.7 MB/s 0:00:00
Installing collected packages: tf_keras
Successfully installed tf_keras-2.20.1

```

```

Batches: 0% | 0/191 [00:00<?, ?it/s]
Batches: 0% | 0/48 [00:00<?, ?it/s]
Batches: 0% | 0/102 [00:00<?, ?it/s]

```

Shapes BERT:

Train: (6090, 384)

```
Val: (1523, 384)
Test: (3263, 384)
```

A ver como nos va ahora con RF

```
[45]: from sklearn.ensemble import RandomForestClassifier
from sklearn.model_selection import GridSearchCV
from sklearn.metrics import f1_score

# Modelo base
rf_base = RandomForestClassifier(
    random_state=RANDOM_SEED,
    n_jobs=-1,
    class_weight='balanced_subsample'
)

# Grid de hiper-parámetros
param_grid = {
    'n_estimators': [100, 300, 500],
    'max_depth': [None, 10, 20],
    'min_samples_split': [2, 5, 10],
    'min_samples_leaf': [1, 2, 4],
    'max_features': ['sqrt', 'log2']
}

grid_search = GridSearchCV(
    estimator=rf_base,
    param_grid=param_grid,
    scoring='f1',
    cv=3,
    n_jobs=-1,
    verbose=2
)

grid_search.fit(X_train_combined, y_train)

print("Mejores hiper-parámetros encontrados:")
print(grid_search.best_params_)

best_rf = grid_search.best_estimator_

y_val_pred = best_rf.predict(X_val_combined)
f1_val = f1_score(y_val, y_val_pred)
print(f"F1 en validation: {f1_val:.4f}")
```

```
Fitting 3 folds for each of 162 candidates, totalling 486 fits
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=100; total time= 2.2s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
```

```

min_samples_split=5, n_estimators=100; total time= 2.7s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 2.9s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 3.6s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=100; total time= 2.6s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=100; total time= 2.4s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=100; total time= 3.7s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=300; total time= 7.5s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=300; total time= 8.1s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=300; total time= 8.1s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=300; total time= 8.1s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=300; total time= 8.1s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=100; total time= 3.4s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
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[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
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[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
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[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=100; total time= 3.7s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=500; total time= 12.8s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=500; total time= 12.4s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=100; total time= 3.2s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=300; total time= 8.3s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=500; total time= 15.0s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=500; total time= 15.3s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=300; total time= 7.3s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=300; total time= 10.2s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,

```

```

min_samples_split=5, n_estimators=100; total time= 3.8s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
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[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
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[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=500; total time= 15.9s
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min_samples_split=5, n_estimators=500; total time= 16.5s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=300; total time= 8.5s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=300; total time= 7.3s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=300; total time= 8.5s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=500; total time= 14.1s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=500; total time= 14.0s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time= 2.8s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=500; total time= 14.4s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time= 2.8s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time= 3.6s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time= 9.0s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=100; total time= 3.8s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time= 9.8s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=100; total time= 3.6s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=500; total time= 16.0s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time= 10.5s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=500; total time= 15.7s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=300; total time= 8.9s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=500; total time= 15.4s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=100; total time= 2.8s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,

```

```

min_samples_split=10, n_estimators=300; total time=  8.7s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=300; total time=  9.2s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=500; total time= 13.6s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=100; total time=  2.8s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=100; total time=  3.1s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=500; total time= 14.8s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=500; total time= 15.0s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=100; total time=  3.4s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=300; total time=  8.5s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
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[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=300; total time=  8.3s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=500; total time= 14.2s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
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[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
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[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=300; total time=  7.5s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=300; total time=  9.5s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=300; total time=  8.8s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=500; total time= 12.6s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=500; total time= 12.8s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=100; total time=  2.7s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=100; total time=  2.4s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,

```

```

min_samples_split=2, n_estimators=100; total time= 2.6s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=500; total time= 14.1s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=300; total time= 8.0s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=300; total time= 8.2s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=300; total time= 8.7s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 2.5s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=500; total time= 13.3s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 2.6s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 2.6s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=500; total time= 13.6s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=300; total time= 6.2s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
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min_samples_split=2, n_estimators=500; total time= 9.5s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=300; total time= 5.1s
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min_samples_split=2, n_estimators=500; total time= 9.8s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=4,
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[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,

```

```

min_samples_split=5, n_estimators=300; total time= 7.0s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=500; total time= 10.4s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
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[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
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[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=300; total time= 6.7s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=500; total time= 9.7s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time= 2.1s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=500; total time= 6.6s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=500; total time= 10.3s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time= 2.1s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=500; total time= 9.6s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time= 2.0s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,

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min_samples_split=5, n_estimators=300; total time= 5.2s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time= 6.0s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=100; total time= 1.8s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time= 6.1s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=500; total time= 9.3s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=100; total time= 2.2s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=100; total time= 2.4s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=500; total time= 10.3s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=300; total time= 5.6s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=300; total time= 4.9s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=300; total time= 5.8s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=100; total time= 2.5s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=500; total time= 9.4s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=100; total time= 2.3s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=100; total time= 1.9s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=500; total time= 10.1s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=300; total time= 5.1s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=500; total time= 10.4s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=300; total time= 5.8s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=300; total time= 6.2s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=500; total time= 8.3s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=500; total time= 9.4s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=100; total time= 2.4s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=100; total time= 2.3s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,

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min_samples_split=10, n_estimators=500; total time= 10.0s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=100; total time= 2.0s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=300; total time= 5.7s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=300; total time= 5.3s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=300; total time= 5.4s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=500; total time= 9.5s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=500; total time= 9.7s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=500; total time= 9.9s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=100; total time= 2.8s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=300; total time= 5.2s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=100; total time= 2.8s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=100; total time= 2.8s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=300; total time= 5.8s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=500; total time= 8.2s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=500; total time= 8.3s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=300; total time= 5.8s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=500; total time= 8.7s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 2.5s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 2.9s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 2.8s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=500; total time= 7.8s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=300; total time= 7.3s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=300; total time= 7.2s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=500; total time= 9.5s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,

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min_samples_split=10, n_estimators=500; total time= 9.8s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=100; total time= 2.7s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=300; total time= 7.7s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=100; total time= 2.7s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=100; total time= 3.1s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=300; total time= 7.5s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=300; total time= 7.9s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=300; total time= 8.3s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=100; total time= 3.0s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=500; total time= 12.4s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=100; total time= 3.2s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=500; total time= 12.8s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=500; total time= 12.3s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=100; total time= 3.0s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=300; total time= 7.6s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=300; total time= 8.1s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=500; total time= 11.0s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=300; total time= 7.9s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=500; total time= 11.6s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=500; total time= 11.9s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=100; total time= 2.6s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=100; total time= 2.7s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=100; total time= 3.0s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=500; total time= 11.2s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,

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min_samples_split=2, n_estimators=300; total time= 8.2s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=300; total time= 7.8s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=300; total time= 7.3s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=500; total time= 13.0s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time= 2.8s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time= 2.6s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=500; total time= 13.2s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time= 2.8s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time= 7.7s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time= 7.7s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time= 8.0s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=100; total time= 2.8s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=500; total time= 12.1s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=500; total time= 12.5s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=100; total time= 3.0s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=100; total time= 3.2s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=500; total time= 13.2s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=500; total time= 11.2s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=300; total time= 7.8s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=300; total time= 7.6s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=300; total time= 7.8s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=500; total time= 13.0s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=500; total time= 11.7s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=100; total time= 3.0s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,

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min_samples_split=5, n_estimators=100; total time= 2.8s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=100; 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= 7.2s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=500; total time= 11.2s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=300; total time= 8.4s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=300; total time= 8.3s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=100; total time= 3.1s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=100; total time= 3.2s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=500; total time= 12.6s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=100; total time= 2.0s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=500; total time= 12.8s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=500; total time= 9.1s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=300; total time= 7.3s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=300; total time= 6.8s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=100; total time= 1.7s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=100; total time= 2.2s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=100; total time= 2.5s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=500; total time= 12.2s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=500; total time= 13.7s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=300; total time= 7.4s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=300; total time= 5.1s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=300; total time= 7.3s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=300; total time= 5.3s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,

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min_samples_split=5, n_estimators=500; total time= 12.1s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=500; total time= 11.6s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=300; total time= 5.7s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=500; total time= 11.2s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=300; total time= 7.8s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 2.0s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 2.1s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 2.2s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=100; total time= 2.3s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=100; total time= 2.4s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=500; total time= 10.3s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=500; total time= 11.2s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=100; total time= 2.3s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=500; total time= 8.1s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=500; total time= 11.3s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=300; total time= 5.2s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=300; total time= 5.4s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=100; total time= 1.8s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=300; total time= 5.9s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=500; total time= 8.8s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=100; total time= 2.1s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=300; total time= 4.8s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=500; total time= 10.1s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=100; total time= 2.2s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,

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```

min_samples_split=5, n_estimators=500; total time= 7.3s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=500; total time= 7.8s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=300; total time= 5.3s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=300; total time= 5.9s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=100; total time= 2.2s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=100; total time= 2.2s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=500; total time= 9.0s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=500; total time= 6.1s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=100; total time= 2.1s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=300; total time= 5.7s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time= 1.6s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=500; total time= 7.1s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=300; total time= 5.0s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=300; total time= 5.2s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time= 1.5s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=500; total time= 8.5s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=500; total time= 6.9s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time= 5.1s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time= 5.7s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=500; total time= 7.5s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time= 5.5s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=100; total time= 1.9s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=500; total time= 8.4s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,

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min_samples_split=2, n_estimators=100; 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= 1.9s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=300; total time= 4.3s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=300; total time= 4.6s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=300; total time= 4.8s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=500; total time= 7.5s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=100; total time= 1.7s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=100; total time= 1.3s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=100; total time= 1.6s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=500; total time= 8.2s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=500; total time= 8.7s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=300; total time= 3.8s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=300; total time= 4.6s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=500; total time= 8.1s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=100; total time= 1.6s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=500; total time= 8.5s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=300; total time= 5.7s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=100; total time= 2.1s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=100; total time= 1.7s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=300; total time= 3.7s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=500; total time= 8.5s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=300; total time= 5.2s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=300; total time= 5.8s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=500; total time= 8.4s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,

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min_samples_split=2, n_estimators=500; total time= 8.6s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=300; total time= 3.8s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=100; total time= 3.2s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=100; total time= 2.7s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=100; total time= 3.2s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=500; total time= 9.6s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=500; total time= 7.1s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=500; total time= 7.9s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=300; total time= 5.6s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=500; total time= 8.3s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=300; total time= 5.8s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 3.2s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 3.5s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=300; total time= 5.9s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=500; total time= 8.3s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 4.1s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=500; total time= 9.5s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=500; total time= 9.6s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=100; total time= 3.4s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=100; total time= 4.0s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=100; total time= 4.2s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=300; total time= 9.3s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=300; total time= 9.6s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=300; total time= 9.7s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,

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min_samples_split=5, n_estimators=300; total time=  9.5s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=300; total time=  9.6s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=100; total time=  3.3s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=500; total time= 12.5s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=100; 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=  4.0s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=500; total time= 15.9s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=500; total time= 17.0s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=300; total time= 10.9s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=300; total time= 10.5s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=500; total time= 15.3s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=500; total time= 13.7s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=300; total time= 11.0s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=100; total time=  2.9s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=100; total time=  3.4s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=100; total time=  3.5s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=500; total time= 11.4s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=300; total time=  8.4s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=500; total time= 16.9s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=300; total time= 10.4s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time=  2.0s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=300; total time=  9.7s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=500; total time= 14.5s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time=  2.8s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,

```

```
min_samples_split=10, n_estimators=500; total time= 15.1s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time= 3.1s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time= 9.7s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time= 10.2s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=100; total time= 4.2s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=500; total time= 15.2s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=500; total time= 14.3s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time= 10.2s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=100; total time= 3.0s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=100; 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= 9.1s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=300; total time= 10.3s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=500; total time= 16.4s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=300; total time= 10.7s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=500; total time= 13.4s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=500; total time= 14.2s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=100; total time= 3.3s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=100; total time= 3.2s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=100; total time= 3.5s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=500; total time= 15.7s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=500; total time= 12.0s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=500; total time= 13.4s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=500; total time= 13.9s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=300; total time= 9.0s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
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min_samples_split=2, n_estimators=300; total time= 8.9s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=300; total time= 9.0s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=100; total time= 2.8s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=100; total time= 3.3s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=300; total time= 6.1s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=100; total time= 3.5s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=300; total time= 8.3s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=100; total time= 2.8s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=300; total time= 8.6s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=100; total time= 2.6s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=500; total time= 13.9s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=500; total time= 13.7s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=100; total time= 3.0s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=300; total time= 7.5s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=500; total time= 15.1s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=300; total time= 8.5s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 2.3s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=500; total time= 12.3s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=300; total time= 9.7s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=300; total time= 5.4s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 2.3s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 2.9s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=500; total time= 14.4s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=500; total time= 14.1s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,

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```

min_samples_split=2, n_estimators=300; total time= 6.6s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=300; total time= 7.3s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=500; total time= 12.2s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=100; total time= 2.4s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=500; total time= 13.9s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=100; total time= 2.5s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=100; total time= 2.8s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=500; total time= 13.9s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=500; total time= 8.5s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=300; total time= 6.4s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=500; total time= 9.6s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=300; total time= 7.0s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=300; total time= 7.0s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=100; total time= 2.0s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=500; total time= 11.1s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=100; total time= 2.2s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=300; total time= 5.6s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=100; total time= 2.7s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=500; total time= 8.6s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=100; total time= 2.2s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=300; total time= 6.7s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=500; total time= 10.7s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=100; total time= 2.1s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=500; total time= 9.6s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,

```

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min_samples_split=10, n_estimators=300; total time= 7.2s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=300; total time= 5.6s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=300; total time= 6.1s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=100; total time= 2.9s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=500; total time= 8.2s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=300; total time= 7.1s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=500; total time= 9.1s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time= 2.0s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time= 2.0s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time= 2.3s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=500; total time= 9.5s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=500; total time= 7.9s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time= 5.0s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time= 5.6s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=100; total time= 1.8s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time= 6.3s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=500; total time= 9.8s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=100; total time= 2.4s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=100; total time= 2.8s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=500; total time= 11.4s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=300; total time= 5.1s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=500; total time= 7.7s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=300; total time= 6.3s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=300; total time= 6.4s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,

```

```

min_samples_split=5, n_estimators=100; total time= 2.1s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=100; total time= 2.5s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=500; total time= 10.5s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=300; total time= 4.9s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=100; total time= 2.4s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=500; total time= 6.9s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=300; total time= 5.8s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=300; total time= 5.2s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=100; total time= 1.4s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=500; total time= 11.1s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=500; total time= 9.0s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=100; total time= 2.4s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=100; total time= 2.4s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=500; total time= 10.3s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=500; total time= 8.0s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=300; total time= 6.3s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=300; total time= 4.8s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=300; total time= 6.1s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=500; total time= 9.4s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=500; total time= 8.9s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=300; total time= 5.2s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=300; total time= 4.6s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=500; total time= 6.4s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=300; total time= 4.7s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,

```

```

min_samples_split=5, n_estimators=500; total time= 7.1s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=500; total time= 7.3s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=500; total time= 5.6s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=500; total time= 5.1s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=500; total time= 4.6s
Mejores hiper-parámetros encontrados:
{'max_depth': 10, 'max_features': 'sqrt', 'min_samples_leaf': 4,
'min_samples_split': 2, 'n_estimators': 500}
F1 en validation: 0.7379

```

Nop, peor que linear regression... Probemos sin hacer el embedding de texto, capaz que ahí mejora. solamente porque al aumentar las dimensiones está empeorando fuerte...

```

[7]: from sklearn.ensemble import RandomForestClassifier
from sklearn.model_selection import GridSearchCV
from sklearn.metrics import f1_score
from sklearn.decomposition import TruncatedSVD
from scipy.stats import randint
from sklearn.ensemble import RandomForestClassifier

N_COMPONENTS = 30 # Voy a tener que jugar un poco con este hiperparámetro

# Transformer para texto (TF-IDF)
tfidf_vectorizer = TfidfVectorizer(
    max_features=5000,
    ngram_range=(1, 2),
    min_df=2,
    max_df=0.95,
    strip_accents='unicode',
    lowercase=True,
    analyzer='word',
    token_pattern=r'\w{1,}',
    stop_words='english'
)

X_train_text = tfidf_vectorizer.fit_transform(X_train[embedding_feature].
    ↪fillna(''))
X_val_text = tfidf_vectorizer.transform(X_val[embedding_feature].fillna(''))
X_test_text = tfidf_vectorizer.transform(test_df[embedding_feature].fillna(''))

print(f"\nTF-IDF vectorizer:")
print(f"  Vocabulary size: {len(tfidf_vectorizer.vocabulary_)}")
print(f"  Feature names (first 10): {tfidf_vectorizer.get_feature_names_out()[:10].tolist()}")

```

```

svd = TruncatedSVD(
    n_components=N_COMPONENTS,
    random_state=RANDOM_SEED
)

X_train_text_15 = svd.fit_transform(X_train_text)
X_val_text_15   = svd.transform(X_val_text)
X_test_text_15  = svd.transform(X_test_text)

X_train_combined = np.hstack([X_train_numeric, X_train_text_15])
X_val_combined   = np.hstack([X_val_numeric,   X_val_text_15])
X_test_combined  = np.hstack([X_test_numeric,  X_test_text_15])

print(f" Test shape: {X_test_combined.shape}")

pd.DataFrame(X_train_combined).head()

# Modelo base

rf = RandomForestClassifier(
    random_state=27,
    n_jobs=-1,
)

param_distributions = {
    'n_estimators': randint(300, 1200),
    'max_depth': [None] + list(range(10, 51, 10)),
    'min_samples_split': randint(2, 15),
    'min_samples_leaf': randint(1, 8),
    'max_features': ['sqrt', 'log2', 0.3, 0.5],
    'class_weight': [None, 'balanced'],
    'bootstrap': [True, False],
}

grid_search.fit(X_train_numeric, y_train)

print("Mejores hiper-parámetros encontrados:")
print(grid_search.best_params_)

best_rf = grid_search.best_estimator_

y_val_pred = best_rf.predict(X_val_numeric)
f1_val = f1_score(y_val, y_val_pred)
print(f"F1 en validation: {f1_val:.4f}")

```

```

TF-IDF vectorizer:
  Vocabulary size: 5000
  Feature names (first 10): ['0', '00', '00 http', '00 pm', '000', '01', '01
04', '02', '03', '04']
  Test shape: (3263, 38)

Fitting 3 folds for each of 162 candidates, totalling 486 fits
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=100; total time= 0.5s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 0.5s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=100; total time= 0.5s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 0.5s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=100; total time= 0.6s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 0.6s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=100; total time= 0.6s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=100; total time= 0.6s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=100; total time= 0.6s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=300; total time= 1.5s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=300; total time= 1.5s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=300; total time= 1.5s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=300; total time= 1.6s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=300; total time= 1.7s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=300; total time= 1.9s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=100; total time= 0.7s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=100; total time= 0.5s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=100; total time= 0.7s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=500; total time= 2.3s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=500; total time= 2.3s
[CV] END
max_depth=None, max_features=sqrt, min_samples_leaf=1, min_samples_split=10,

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```

n_estimators=300; total time= 1.7s

[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=300; total time= 1.3s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=500; total time= 2.6s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=500; total time= 2.8s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=300; total time= 1.7s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=100; total time= 0.5s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=500; total time= 2.5s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=100; total time= 0.7s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=500; total time= 2.6s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=100; total time= 0.7s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=300; total time= 1.6s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=300; total time= 1.4s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=500; total time= 2.2s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=300; total time= 1.5s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=500; total time= 2.3s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=500; total time= 2.6s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time= 0.6s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time= 1.3s
[CV] END
max_depth=None, max_features=sqrt, min_samples_leaf=2, min_samples_split=10,
n_estimators=100; total time= 0.6s

[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time= 1.4s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time= 0.5s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time= 1.4s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=500; total time= 2.3s
[CV] END max_depth=None, max_features=sqrt, min_samples_leaf=2,

```







```

min_samples_split=10, n_estimators=500; total time= 2.7s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=500; total time= 2.8s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time= 0.8s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time= 0.6s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time= 0.7s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time= 2.0s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time= 1.7s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=500; total time= 2.7s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time= 1.8s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=500; total time= 3.0s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=100; total time= 0.7s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=100; total time= 0.6s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=100; total time= 0.6s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=500; total time= 3.0s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=300; total time= 1.7s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=300; total time= 1.8s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=500; total time= 2.7s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=100; total time= 0.5s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=500; total time= 2.8s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=100; total time= 0.7s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=500; total time= 3.0s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=100; total time= 0.6s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=300; total time= 1.6s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,

```

```

min_samples_split=2, n_estimators=300; total time= 1.6s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=500; total time= 2.7s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=300; total time= 1.6s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=100; total time= 0.6s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=500; total time= 2.8s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=500; total time= 2.6s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=100; total time= 0.6s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=100; total time= 0.7s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=300; total time= 1.5s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=300; total time= 1.7s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=300; total time= 1.5s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=100; total time= 0.5s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=500; total time= 2.3s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=100; total time= 0.6s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=100; total time= 0.6s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=500; total time= 2.8s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=300; total time= 1.4s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=500; total time= 2.9s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=300; total time= 1.6s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=300; total time= 1.6s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=500; total time= 2.5s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 0.4s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 0.5s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=500; total time= 2.6s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,

```

```

min_samples_split=5, n_estimators=500; total time= 2.7s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 0.6s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=300; total time= 1.5s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=300; total time= 1.4s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=500; total time= 2.5s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=300; total time= 1.7s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=500; total time= 2.7s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=100; total time= 0.6s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=100; total time= 0.5s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=100; total time= 0.6s
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min_samples_split=5, n_estimators=300; total time= 1.3s
[CV] END max_depth=None, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=500; total time= 2.6s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=300; total time= 1.3s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=500; total time= 2.0s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=300; total time= 1.4s
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min_samples_split=2, n_estimators=100; total time= 0.4s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=500; total time= 2.3s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=100; total time= 0.5s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=100; total time= 0.6s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=500; total time= 2.5s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=300; total time= 1.3s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=300; 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= 1.5s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=500; total time= 2.1s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,

```

```

min_samples_split=5, n_estimators=500; total time= 2.1s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
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[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=500; total time= 2.3s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=100; total time= 0.4s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=300; total time= 1.2s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=100; total time= 0.7s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=300; total time= 1.4s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=500; total time= 2.1s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=300; total time= 1.5s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time= 0.5s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time= 0.5s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=500; total time= 2.2s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=500; total time= 2.3s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=100; total time= 0.4s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time= 1.3s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time= 1.3s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=500; total time= 2.1s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=500; total time= 2.0s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=100; total time= 0.5s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=500; total time= 2.1s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=100; total time= 0.4s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=4,
min_samples_split=2, n_estimators=100; total time= 0.4s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,
min_samples_split=10, n_estimators=300; total time= 1.3s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=2,

```







```
min_samples_split=5, n_estimators=300; total time= 1.4s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=300; total time= 1.6s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=500; total time= 2.3s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=500; total time= 2.4s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=500; total time= 2.4s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=100; total time= 0.6s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=100; total time= 0.7s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=300; total time= 1.3s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=100; total time= 0.6s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=300; total time= 1.3s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=300; total time= 1.5s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=500; total time= 2.2s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=500; total time= 2.5s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=100; total time= 0.6s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=100; total time= 0.5s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=5, n_estimators=500; 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= 1.4s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=300; total time= 1.5s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=300; total time= 1.6s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=500; total time= 2.4s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=2,
min_samples_split=10, n_estimators=500; total time= 2.4s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=100; total time= 0.5s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
```



```
min_samples_split=2, n_estimators=300; total time= 1.7s
[CV] END max_depth=10, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=500; total time= 2.4s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=100; total time= 0.7s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=100; total time= 0.6s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=100; total time= 0.6s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=300; total time= 1.5s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=300; total time= 1.6s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=100; total time= 0.6s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=500; total time= 2.4s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=500; total time= 2.4s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=300; 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= 0.6s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=2, n_estimators=500; total time= 2.8s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=100; total time= 0.6s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=500; total time= 2.2s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=300; total time= 1.5s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=10, n_estimators=300; total time= 1.5s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=500; total time= 2.5s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=100; total time= 0.6s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=1,
min_samples_split=5, n_estimators=500; total time= 2.6s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=100; total time= 0.5s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=5, n_estimators=100; total time= 0.6s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
min_samples_split=2, n_estimators=300; total time= 1.4s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=2,
```





```
min_samples_split=5, n_estimators=500; total time= 2.3s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 0.7s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=5, n_estimators=500; total time= 2.5s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 0.7s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=100; total time= 1.0s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=500; total time= 2.2s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=300; total time= 1.9s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=500; total time= 2.3s
[CV] END max_depth=20, max_features=sqrt, min_samples_leaf=4,
min_samples_split=10, n_estimators=500; total time= 2.5s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=100; total time= 0.6s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=300; total time= 1.8s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=100; total time= 0.7s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=300; total time= 1.5s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=300; total time= 2.1s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=100; total time= 0.8s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=300; total time= 1.8s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=5, n_estimators=300; total time= 1.9s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=100; total time= 0.6s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=500; total time= 2.7s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=500; total time= 2.8s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=2, n_estimators=500; total time= 2.9s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=300; total time= 1.4s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
min_samples_split=2, n_estimators=100; total time= 0.9s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=1,
min_samples_split=10, n_estimators=300; total time= 1.5s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=2,
```





```

min_samples_split=2, n_estimators=500; total time= 2.8s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=2, n_estimators=500; total time= 2.7s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=300; total time= 1.3s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=300; total time= 1.6s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=500; total time= 2.3s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=300; total time= 1.5s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=500; total time= 2.4s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=5, n_estimators=500; total time= 2.3s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=500; total time= 1.7s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=500; total time= 1.8s
[CV] END max_depth=20, max_features=log2, min_samples_leaf=4,
min_samples_split=10, n_estimators=500; total time= 1.7s
Mejores hiper-parámetros encontrados:
{'max_depth': 20, 'max_features': 'log2', 'min_samples_leaf': 4,
'min_samples_split': 2, 'n_estimators': 300}
F1 en validation: 0.7326

```

Cada vez peor! Quizás Random Forest no es el mejor modelo para este problema. Voy a probar con XGBoost en el notebook 4 y bajar a csv el mejor modelo que sacamos con esto (el primero! super frustrante)