

models

December 3, 2024

1 Next steps: Model development and evaluation

With the data exploration and preprocessing completed in the EDA notebook, the focus now shifts to building, fine-tuning, and evaluating predictive models for the Bank Marketing Dataset. The objective is to leverage the cleaned and prepared data to accurately predict whether a client will subscribe to a term deposit.

1.1 Objectives

1. **Model selection:** Explore and implement a variety of machine learning algorithms suitable for binary classification, including:
 - Decision Trees
 - Random Forest
 - Ada Boosted Machine
 - Gradient Boosted Machine (e.g. XGBoost, LightGBM)
2. **Baseline Model:** Begin with a simple model (e.g. Decision Tree) to establish a baseline performance. Use this as a reference for comparing more complex models.
3. **Feature Importance Analysis:** Investigate the contribution of individual features to the predictions, providing insights into the key drivers of client behavior.
4. **Hyperparameter Tuning:** Optimize model performance using grid search or randomized search with cross-validation to identify the best hyperparameters for each algorithm.
5. **Performance evaluation:** Assess models using a combination of evaluation metrics such as:
 - Accuracy
 - Precision, Recall. and F1-score
 - Area Under the ROC (AUC-ROC)
 - Confusion Matrix Analysis
6. **Insights and recommendations:** Use the results to provide actionable recommendations for improving future marketing strategies, focusing on targeting clients most likely to respond positively to campaigns.

This notebook will detail the process from initial model development to final evaluation, culminating in the selection of the best-performing model and the extraction of meaningful business insights.

1.2 Model selection and baseline model

```
[1]: # Import libraries
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
from sklearn.tree import DecisionTreeClassifier
from sklearn.ensemble import RandomForestClassifier, AdaBoostClassifier
import xgboost as xgb
from xgboost import plot_importance
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import OneHotEncoder, StandardScaler
from sklearn.compose import ColumnTransformer
from sklearn.metrics import accuracy_score, precision_score, recall_score, \
    f1_score, roc_auc_score

[2]: data = pd.read_csv('./data/final_data.csv', sep='|')

[3]: data.sample()

[3]:      contact housing poutcome      job loan month marital default \
31425  cellular      no unknown  student  no  mar  single      no

      education age previous balance day_of_week campaign duration  y
31425  secondary  27         0     213         27         1      378  yes

[4]: categorical_columns = \
    ['job', 'marital', 'education', 'default', 'housing', 'loan', 'contact', 'month', 'poutcome']
numerical_columns = ['day_of_week', 'age', 'balance', 'campaign', 'duration']
target = 'y'

[5]: # Split the dataset into training and test sets
X, y = data.drop(columns=['y'], data['y'].map({'yes':1, 'no':0})
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, \
    random_state=42, stratify=y)

# Create a preprocessing pipeline
preprocessor = ColumnTransformer(
    transformers=[
        ("num", StandardScaler(), numerical_columns), # Standardize numerical \
    columns
        ("cat", OneHotEncoder(drop="first", sparse_output=False), \
    categorical_columns) # Encode categorical columns
    ]
)

# Initialize models
models = {
```

```

    "Decision Tree": DecisionTreeClassifier(random_state=42),
    "Random Forest": RandomForestClassifier(random_state=42, n_jobs=-1),
    "XGBoost": xgb.XGBClassifier(use_label_encoder=False,
    ↪eval_metric="logloss", random_state=42),
    "AdaBoost": AdaBoostClassifier(random_state=42)
}

# Function to evaluate models
def evaluate_model(name, model):

    # Apply the preprocessing pipeline
    X_preprocessed_train = preprocessor.fit_transform(X_train)
    model.fit(X_preprocessed_train, y_train)
    X_preprocessed_test = preprocessor.transform(X_test)
    y_pred = model.predict(X_preprocessed_test)
    y_proba = model.predict_proba(X_preprocessed_test)[: , 1]
    print(f"--- {name} ---")
    acc = accuracy_score(y_test, y_pred)
    print(f"Accuracy: {acc:.4f}")
    prec_score = precision_score(y_test, y_pred)
    print(f"Precision: {prec_score:.4f}")
    rec_score = recall_score(y_test, y_pred)
    print(f"Recall: {rec_score:.4f}")
    f1score = f1_score(y_test, y_pred)
    print(f"F1-Score: {f1score:.4f}")
    roc = roc_auc_score(y_test, y_proba)
    print(f"AUC-ROC: {roc:.4f}")
    print()
    return {name : {'Accuracy':acc, 'Precision':prec_score, 'Recall':rec_score,
    ↪'F1-Score':f1score, 'AUC-ROC':roc}}

# Evaluate each model
results = {}
for name, model in models.items():
    results.update(evaluate_model(name, model))

```

--- Decision Tree ---

Accuracy: 0.8740
Precision: 0.4626
Recall: 0.4735
F1-Score: 0.4680
AUC-ROC: 0.7003

--- Random Forest ---

Accuracy: 0.9041
Precision: 0.6533
Recall: 0.3847

F1-Score: 0.4842
AUC-ROC: 0.9264

```
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.12/site-packages/xgboost/core.py:158: UserWarning: [22:06:41] WARNING: /workspace/src/learner.cc:740: Parameters: { "use_label_encoder" } are not used.
```

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

```
--- XGBoost ---  
Accuracy: 0.9020  
Precision: 0.6036  
Recall: 0.4735  
F1-Score: 0.5307  
AUC-ROC: 0.9266
```

```
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.12/site-packages/sklearn/ensemble/_weight_boosting.py:527: FutureWarning: The SAMME.R algorithm (the default) is deprecated and will be removed in 1.6. Use the SAMME algorithm to circumvent this warning.
```

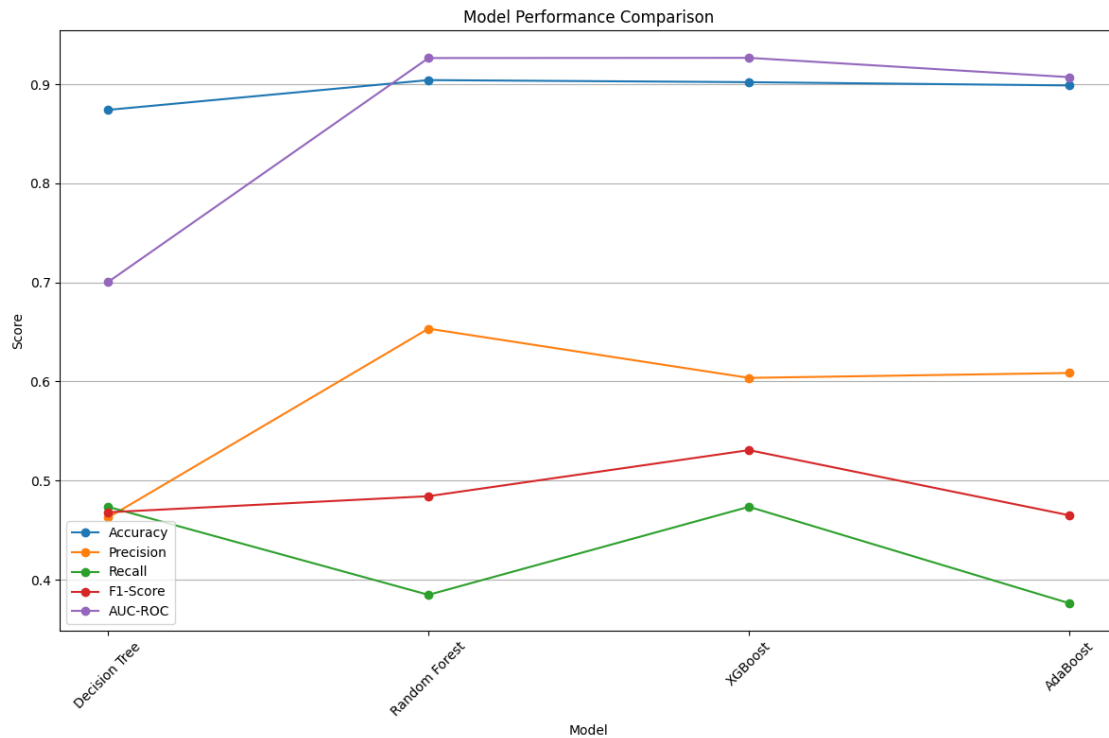
```
warnings.warn(
```

```
--- AdaBoost ---  
Accuracy: 0.8987  
Precision: 0.6086  
Recall: 0.3762  
F1-Score: 0.4650  
AUC-ROC: 0.9071
```

```
[6]: results_df = pd.DataFrame(results).T
```

```
[7]: metrics = results_df.columns  
x = range(results_df.shape[0])  
  
plt.figure(figsize=(12, 8))  
for metric in metrics:  
    plt.plot(x, results_df[metric], marker='o', label=metric)  
  
plt.xticks(x, results.keys(), rotation=45)  
plt.xlabel("Model")  
plt.ylabel("Score")  
plt.title("Model Performance Comparison")  
plt.legend()  
plt.grid(axis="y")
```

```
plt.tight_layout()
plt.show()
```



To determine the best model, we need to evaluate which one performs best based on your specific objectives and the evaluation metrics provided.

Metric importance

1. **Accuracy:** Indicates overall correctness but can be misleading in imbalanced datasets.
2. **Precision:** Measures how many of the predicted positives are actually positive. High precision reduces false positives.
3. **Recall:** Measures how many of the actual positives are correctly identified. High recall reduces false negatives.
4. **F1-score:** A harmonic mean of precision and recall, balancing the two metrics.
5. **AUC-ROC:** Evaluates the model's ability to distinguish between classes across different thresholds.

1.2.1 Observations

1. **AUC-ROC:**
 - **XGBoost (0.9266)** and **Random Forest (0.9264)** have the highest AUC-ROC, indicating excellent ability to distinguish between classes.
 - **Decision Tree (0.7003)** lags significantly, showing it's not a strong classifier in this setup.
2. **F1-Score:**

- **XGBoost (0.5307)** leads here, which balances precision and recall effectively.
 - **Random Forest** has a lower **F1-Score (0.4842)**, indicating it may struggle with balanced classification compared XGBoost.
3. **Precision and Recall:**
- **XGBoost** has a balanced precision (**0.6036**) and recall (**0.4735**).
 - **Random Forest** has higher precision (**0.6533**) but lower recall (**0.3847**), suggesting it predicts fewer false positives but misses more true positives.
4. **Accuracy:**
- **Random Forest (0.9041)** edges out slightly over **XGBoost**, but this metric alone is not sufficient for comparison due to class imbalances.

1.2.2 Conclusion

XGBoost is the better model in this case because:

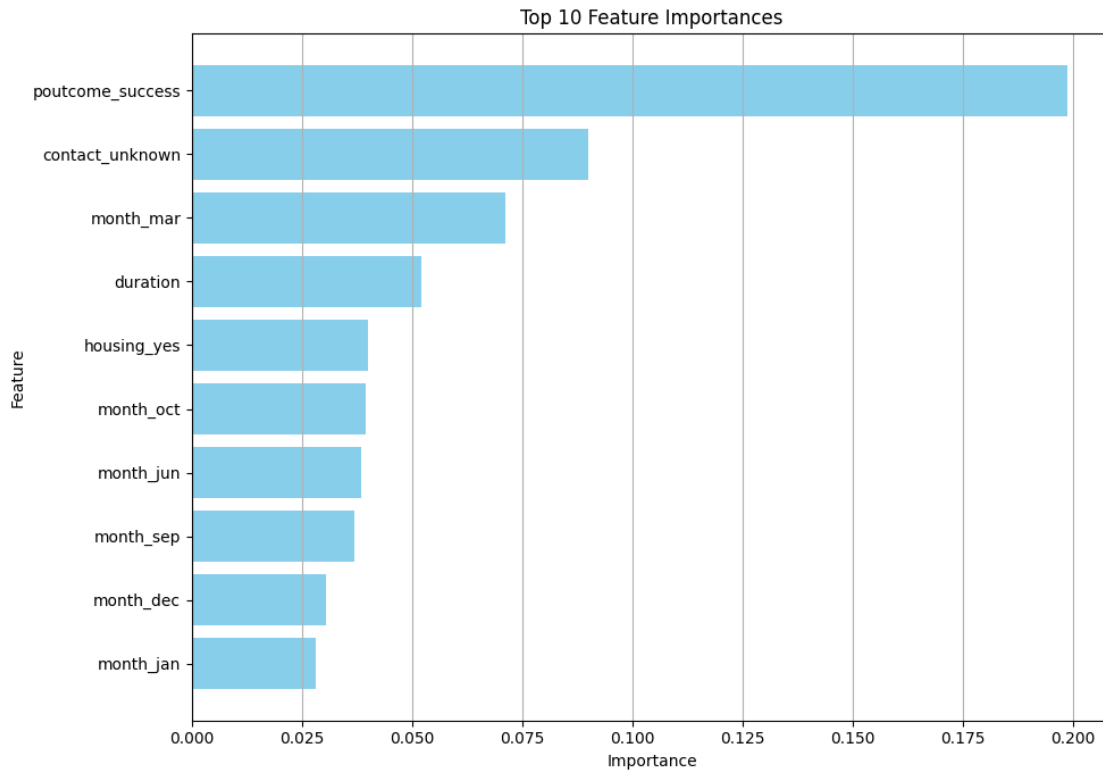
- It achieves the best F1-score (balancing precision and recall).
- It has the highest AUC-ROC, indicating excellent class separation.
- It provides a better balance between precision and recall, which is crucial in scenarios where both false positives and false negatives have significant costs (e.g., marketing campaigns).

1.3 Feature importance analysis and hyperparameter tuning

```
[8]: # Extract feature importances
X_preprocessed = preprocessor.fit_transform(X_train)
feature_names = (
    numerical_columns +
    preprocessor.named_transformers_["cat"].
    get_feature_names_out(categorical_columns).tolist()
)

importance_df = pd.DataFrame({
    "Feature": feature_names,
    "Importance": models['XGBoost'].feature_importances_
}).sort_values(by="Importance", ascending=False)
```

```
[9]: # Plot feature importance
plt.figure(figsize=(10, 7))
plt.barh(importance_df["Feature"][:10], importance_df["Importance"][:10],
        color="skyblue")
plt.title("Top 10 Feature Importances")
plt.xlabel("Importance")
plt.ylabel("Feature")
plt.gca().invert_yaxis()
plt.grid(axis="x")
plt.tight_layout()
plt.show()
```



```
[10]: importance_df.head(10)
```

```
[10]:
```

	Feature	Importance
37	poutcome_success	0.198781
24	contact_unknown	0.090030
31	month_mar	0.071048
4	duration	0.051980
21	housing_yes	0.040042
34	month_oct	0.039389
30	month_jun	0.038397
35	month_sep	0.036747
26	month_dec	0.030506
28	month_jan	0.028042

1.3.1 Explanation:

- **importance_type="gain"**: This measures the average improvement in accuracy brought by a feature across all splits it appears in.
- The top 10 features will be visualized in a bar chart for easier interpretation.

1.3.2 Hyperparameter Tuning with Bayesian Optimization (Optuna)

```
[11]: import optuna
from xgboost import XGBClassifier
from sklearn.metrics import f1_score, accuracy_score, precision_score, recall_score, roc_auc_score
from sklearn.model_selection import train_test_split

# Define the objective function for Optuna optimization
def objective(trial):
    # Hyperparameter search space
    param = {
        "n_estimators": trial.suggest_int("n_estimators", 50, 200, step=50),
        "max_depth": trial.suggest_int("max_depth", 3, 10),
        "learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
        "subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
        "colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
        "eval_metric": "logloss",
        "use_label_encoder": False
    }

    # Create and train the model with suggested parameters
    model = XGBClassifier(**param)
    X_prep_train = preprocessor.fit_transform(X_train)
    model.fit(X_prep_train, y_train)

    # Predict and calculate the evaluation metrics
    X_prep_test = preprocessor.fit_transform(X_test)
    y_pred = model.predict(X_prep_test)
    y_proba = model.predict_proba(X_prep_test)[:, 1]

    accuracy = accuracy_score(y_test, y_pred)
    precision = precision_score(y_test, y_pred)
    recall = recall_score(y_test, y_pred)
    f1 = f1_score(y_test, y_pred)
    auc_roc = roc_auc_score(y_test, y_proba)

    # Return the F1-score (or any other metric you wish to optimize)
    return f1

# Create an Optuna study
study = optuna.create_study(direction="maximize")

# Optimize hyperparameters
study.optimize(objective, n_trials=100) # You can adjust the number of trials as needed
```



```

# Print the best hyperparameters
print("Best hyperparameters found: ", study.best_params)

# Train the model with the best parameters
best_params = study.best_params
best_xgb_model = XGBClassifier(**best_params)
X_prep_train = preprocessor.fit_transform(X_train)
best_xgb_model.fit(X_prep_train, y_train)

# Evaluate the best model on the test set
X_prep_test = preprocessor.fit_transform(X_test)
y_pred = best_xgb_model.predict(X_prep_test)
y_proba = best_xgb_model.predict_proba(X_prep_test)[: , 1]

print("\nEvaluation Metrics:")
print(f"Accuracy: {accuracy_score(y_test, y_pred):.4f}")
print(f"Precision: {precision_score(y_test, y_pred):.4f}")
print(f"Recall: {recall_score(y_test, y_pred):.4f}")
print(f"F1-Score: {f1_score(y_test, y_pred):.4f}")
print(f"AUC-ROC: {roc_auc_score(y_test, y_proba):.4f}")

```

/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.12/site-packages/tqdm/auto.py:21: TqdmWarning: IPProgress not found. Please update jupyter and ipywidgets. See https://ipywidgets.readthedocs.io/en/stable/user_install.html

```

from .autonotebook import tqdm as notebook_tqdm
[I 2024-12-03 22:06:44,074] A new study created in memory with name: no-
name-290d8319-2f0c-4830-80c7-5d89bad28b9b
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.

```

```

"learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.

```

```

"subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.

```

```

"colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:06:44] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.

```

```

warnings.warn(msg, UserWarning)
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.

```

```

12/site-packages/sklearn/metrics/_classification.py:1531:
UndefinedMetricWarning: Precision is ill-defined and being set to 0.0 due to no
predicted samples. Use `zero_division` parameter to control this behavior.
    _warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
[I 2024-12-03 22:06:45,555] Trial 0 finished with value: 0.0 and parameters:
{'n_estimators': 200, 'max_depth': 10, 'learning_rate': 2.3878040349943836e-05,
'subsample': 0.7824681889544511, 'colsample_bytree': 0.9672544421230683}. Best
is trial 0 with value: 0.0.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
    "learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
    "subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
    "colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:06:45] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.

warnings.warn(msg, UserWarning)
[I 2024-12-03 22:06:46,083] Trial 1 finished with value: 0.4731442365721183 and
parameters: {'n_estimators': 100, 'max_depth': 8, 'learning_rate':
0.031164835108640907, 'subsample': 0.754456802296281, 'colsample_bytree':
0.9690708461803301}. Best is trial 1 with value: 0.4731442365721183.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
    "learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
    "subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
    "colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:06:46] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.

```

```

warnings.warn(smsg, UserWarning)
[I 2024-12-03 22:06:46,880] Trial 2 finished with value: 0.3620933521923621 and
parameters: {'n_estimators': 150, 'max_depth': 9, 'learning_rate':
0.014234355293878006, 'subsample': 0.9444663023808819, 'colsample_bytree':
0.725679240906176}. Best is trial 1 with value: 0.4731442365721183.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
"learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:06:46] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.

warnings.warn(smsg, UserWarning)
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/sklearn/metrics/_classification.py:1531:
UndefinedMetricWarning: Precision is ill-defined and being set to 0.0 due to no
predicted samples. Use `zero_division` parameter to control this behavior.
_warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
[I 2024-12-03 22:06:47,667] Trial 3 finished with value: 0.0 and parameters:
{'n_estimators': 100, 'max_depth': 10, 'learning_rate': 0.002297856173650502,
'subsample': 0.8827150380306267, 'colsample_bytree': 0.9514354860902019}. Best
is trial 1 with value: 0.4731442365721183.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
"learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.

```

```
12/site-packages/xgboost/core.py:158: UserWarning: [22:06:47] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.
```

```
warnings.warn(smsg, UserWarning)
[I 2024-12-03 22:06:47,927] Trial 4 finished with value: 0.4090606262491672 and
parameters: {'n_estimators': 100, 'max_depth': 4, 'learning_rate':
0.03836975369296037, 'subsample': 0.8203100688862112, 'colsample_bytree':
0.7961329499916545}. Best is trial 1 with value: 0.4731442365721183.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
"learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:06:47] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.
```

```
warnings.warn(smsg, UserWarning)
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/sklearn/metrics/_classification.py:1531:
UndefinedMetricWarning: Precision is ill-defined and being set to 0.0 due to no
predicted samples. Use `zero_division` parameter to control this behavior.
_warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
[I 2024-12-03 22:06:48,232] Trial 5 finished with value: 0.0 and parameters:
{'n_estimators': 50, 'max_depth': 9, 'learning_rate': 0.0011303486679222524,
'subsample': 0.9620254077405932, 'colsample_bytree': 0.9705306927889956}. Best
is trial 1 with value: 0.4731442365721183.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
"learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
```

```
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:06:48] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.
```

```
warnings.warn(smsg, UserWarning)
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/sklearn/metrics/_classification.py:1531:
UndefinedMetricWarning: Precision is ill-defined and being set to 0.0 due to no
predicted samples. Use `zero_division` parameter to control this behavior.
_warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
[I 2024-12-03 22:06:48,891] Trial 6 finished with value: 0.0 and parameters:
{'n_estimators': 150, 'max_depth': 7, 'learning_rate': 0.00020882203211672494,
'subsample': 0.8359388621812753, 'colsample_bytree': 0.7046623359144167}. Best
is trial 1 with value: 0.4731442365721183.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
"learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:06:48] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.
```

```
warnings.warn(smsg, UserWarning)
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/sklearn/metrics/_classification.py:1531:
UndefinedMetricWarning: Precision is ill-defined and being set to 0.0 due to no
predicted samples. Use `zero_division` parameter to control this behavior.
_warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
[I 2024-12-03 22:06:49,199] Trial 7 finished with value: 0.0 and parameters:
{'n_estimators': 100, 'max_depth': 4, 'learning_rate': 0.0001237220954759326,
'subsample': 0.7794202742832415, 'colsample_bytree': 0.8118683587445195}. Best
is trial 1 with value: 0.4731442365721183.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
```

```
log=True) instead.
"learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:06:49] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.
```

```
warnings.warn(smsg, UserWarning)
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/sklearn/metrics/_classification.py:1531:
UndefinedMetricWarning: Precision is ill-defined and being set to 0.0 due to no
predicted samples. Use `zero_division` parameter to control this behavior.
_warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
[I 2024-12-03 22:06:49,646] Trial 8 finished with value: 0.0 and parameters:
{'n_estimators': 150, 'max_depth': 7, 'learning_rate': 0.001123751002079155,
'subsample': 0.9712164557680751, 'colsample_bytree': 0.8421094302794943}. Best
is trial 1 with value: 0.4731442365721183.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
"learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:06:49] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.
```

```
warnings.warn(smsg, UserWarning)
[I 2024-12-03 22:06:49,928] Trial 9 finished with value: 0.5202890494719289 and
parameters: {'n_estimators': 100, 'max_depth': 6, 'learning_rate':
0.08999999354064352, 'subsample': 0.7030065018653308, 'colsample_bytree':
0.7608757296654705}. Best is trial 9 with value: 0.5202890494719289.
```

```

/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
    "learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
    "subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
    "colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:06:50] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.

```

```

warnings.warn(msg, UserWarning)
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/sklearn/metrics/_classification.py:1531:
UndefinedMetricWarning: Precision is ill-defined and being set to 0.0 due to no
predicted samples. Use `zero_division` parameter to control this behavior.
    _warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
[I 2024-12-03 22:06:50,148] Trial 10 finished with value: 0.0 and parameters:
{'n_estimators': 50, 'max_depth': 5, 'learning_rate': 0.007577225471878128,
'subsample': 0.7015683495565193, 'colsample_bytree': 0.7591434281884638}. Best
is trial 9 with value: 0.5202890494719289.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
    "learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
    "subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
    "colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:06:50] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.

```

```

warnings.warn(msg, UserWarning)
[I 2024-12-03 22:06:50,468] Trial 11 finished with value: 0.5189309576837416 and

```

```

parameters: {'n_estimators': 100, 'max_depth': 6, 'learning_rate':
0.0920462379554431, 'subsample': 0.7105435822682958, 'colsample_bytree':
0.8995952274203483}. Best is trial 9 with value: 0.5202890494719289.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
  "learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
  "subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
  "colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:06:50] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.

```

```

warnings.warn(smsg, UserWarning)
[I 2024-12-03 22:06:50,833] Trial 12 finished with value: 0.4712430426716141 and
parameters: {'n_estimators': 50, 'max_depth': 6, 'learning_rate':
0.07327452534440856, 'subsample': 0.7059236443852345, 'colsample_bytree':
0.9071397383408876}. Best is trial 9 with value: 0.5202890494719289.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
  "learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
  "subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
  "colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:06:50] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.

```

```

warnings.warn(smsg, UserWarning)
[I 2024-12-03 22:06:51,463] Trial 13 finished with value: 0.5407447382622774 and
parameters: {'n_estimators': 200, 'max_depth': 6, 'learning_rate':
0.09025643606867433, 'subsample': 0.7390112577617156, 'colsample_bytree':

```



```

0.9073395723952752}. Best is trial 13 with value: 0.5407447382622774.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
"learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:06:51] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.

```

```

warnings.warn(msg, UserWarning)
[I 2024-12-03 22:06:52,029] Trial 14 finished with value: 0.2703125 and
parameters: {'n_estimators': 200, 'max_depth': 5, 'learning_rate':
0.007625394597723205, 'subsample': 0.7440515324446617, 'colsample_bytree':
0.8937528340355195}. Best is trial 13 with value: 0.5407447382622774.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
"learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:06:52] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.

```

```

warnings.warn(msg, UserWarning)
[I 2024-12-03 22:06:52,337] Trial 15 finished with value: 0.018674136321195144
and parameters: {'n_estimators': 200, 'max_depth': 3, 'learning_rate':
0.00498670583992949, 'subsample': 0.8945772071842426, 'colsample_bytree':
0.867584727058275}. Best is trial 13 with value: 0.5407447382622774.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has

```

```

been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
"learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:06:52] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.

```

```

warnings.warn(msg, UserWarning)
[I 2024-12-03 22:06:52,949] Trial 16 finished with value: 0.39919082939986517
and parameters: {'n_estimators': 150, 'max_depth': 5, 'learning_rate':
0.021382109095116255, 'subsample': 0.8003936465422405, 'colsample_bytree':
0.7699012507109175}. Best is trial 13 with value: 0.5407447382622774.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
"learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:06:53] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.

```

```

warnings.warn(msg, UserWarning)
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/sklearn/metrics/_classification.py:1531:
UndefinedMetricWarning: Precision is ill-defined and being set to 0.0 due to no
predicted samples. Use `zero_division` parameter to control this behavior.
_warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
[I 2024-12-03 22:06:53,911] Trial 17 finished with value: 0.0 and parameters:
{'n_estimators': 200, 'max_depth': 8, 'learning_rate': 0.0003319186695758312,

```

```
'subsample': 0.7416942728482252, 'colsample_bytree': 0.9312000754422753}. Best
is trial 13 with value: 0.5407447382622774.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
"learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:06:54] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.
```

```
warnings.warn(smsg, UserWarning)
[I 2024-12-03 22:06:54,491] Trial 18 finished with value: 0.5331125827814569 and
parameters: {'n_estimators': 150, 'max_depth': 6, 'learning_rate':
0.09994422742262471, 'subsample': 0.8611790932446206, 'colsample_bytree':
0.861398778356848}. Best is trial 13 with value: 0.5407447382622774.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
"learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:06:54] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.
```

```
warnings.warn(smsg, UserWarning)
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/sklearn/metrics/_classification.py:1531:
UndefinedMetricWarning: Precision is ill-defined and being set to 0.0 due to no
predicted samples. Use `zero_division` parameter to control this behavior.
```

```

_warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
[I 2024-12-03 22:06:55,277] Trial 19 finished with value: 0.0 and parameters:
{'n_estimators': 200, 'max_depth': 7, 'learning_rate': 2.2071573931949593e-05,
'subsample': 0.8782790028256819, 'colsample_bytree': 0.8471601459272466}. Best
is trial 13 with value: 0.5407447382622774.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
"learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:06:55] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.

```

```

warnings.warn(smsg, UserWarning)
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/sklearn/metrics/_classification.py:1531:
UndefinedMetricWarning: Precision is ill-defined and being set to 0.0 due to no
predicted samples. Use `zero_division` parameter to control this behavior.
_warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
[I 2024-12-03 22:06:55,562] Trial 20 finished with value: 0.0 and parameters:
{'n_estimators': 150, 'max_depth': 3, 'learning_rate': 0.0031345171084678682,
'subsample': 0.8566792236014796, 'colsample_bytree': 0.8678998797669539}. Best
is trial 13 with value: 0.5407447382622774.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
"learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:06:55] WARNING:

```

```
/workspace/src/learner.cc:740:  
Parameters: { "use_label_encoder" } are not used.
```

```
warnings.warn(msg, UserWarning)  
[I 2024-12-03 22:06:56,127] Trial 21 finished with value: 0.5418933623503809 and  
parameters: {'n_estimators': 150, 'max_depth': 6, 'learning_rate':  
0.09870624105747908, 'subsample': 0.9113124917580141, 'colsample_bytree':  
0.8125989742612512}. Best is trial 21 with value: 0.5418933623503809.  
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has  
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See  
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,  
log=True) instead.  
"learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),  
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been  
deprecated in v3.0.0. This feature will be removed in v6.0.0. See  
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.  
"subsample": trial.suggest_uniform("subsample", 0.7, 1.0),  
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been  
deprecated in v3.0.0. This feature will be removed in v6.0.0. See  
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.  
"colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),  
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.  
12/site-packages/xgboost/core.py:158: UserWarning: [22:06:56] WARNING:  
/workspace/src/learner.cc:740:  
Parameters: { "use_label_encoder" } are not used.
```

```
warnings.warn(msg, UserWarning)  
[I 2024-12-03 22:06:56,814] Trial 22 finished with value: 0.5104166666666666 and  
parameters: {'n_estimators': 150, 'max_depth': 6, 'learning_rate':  
0.0402777697923204, 'subsample': 0.9068293693546718, 'colsample_bytree':  
0.99952762763562}. Best is trial 21 with value: 0.5418933623503809.  
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has  
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See  
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,  
log=True) instead.  
"learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),  
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been  
deprecated in v3.0.0. This feature will be removed in v6.0.0. See  
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.  
"subsample": trial.suggest_uniform("subsample", 0.7, 1.0),  
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been  
deprecated in v3.0.0. This feature will be removed in v6.0.0. See  
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.  
"colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),  
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.  
12/site-packages/xgboost/core.py:158: UserWarning: [22:06:56] WARNING:  
/workspace/src/learner.cc:740:  
Parameters: { "use_label_encoder" } are not used.
```

```
warnings.warn(smsg, UserWarning)
[I 2024-12-03 22:06:57,584] Trial 23 finished with value: 0.4018629407850965 and
parameters: {'n_estimators': 200, 'max_depth': 5, 'learning_rate':
0.015586714723948172, 'subsample': 0.9222555883918784, 'colsample_bytree':
0.8221800734999732}. Best is trial 21 with value: 0.5418933623503809.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
"learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:06:57] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.
```

```
warnings.warn(smsg, UserWarning)
[I 2024-12-03 22:06:58,174] Trial 24 finished with value: 0.5216426193118757 and
parameters: {'n_estimators': 150, 'max_depth': 8, 'learning_rate':
0.04708803509016031, 'subsample': 0.8609164943313201, 'colsample_bytree':
0.8737285577943135}. Best is trial 21 with value: 0.5418933623503809.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
"learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:06:58] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.
```

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

```
[I 2024-12-03 22:06:58,557] Trial 25 finished with value: 0.5194954128440367 and
parameters: {'n_estimators': 150, 'max_depth': 4, 'learning_rate':
0.09919716644485861, 'subsample': 0.9956942886466662, 'colsample_bytree':
0.9250767526618534}. Best is trial 21 with value: 0.5418933623503809.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
```

```
    "learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
```

```
    "subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
```

```
    "colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:06:58] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.
```

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

```
[I 2024-12-03 22:06:59,205] Trial 26 finished with value: 0.4186965108624095 and
parameters: {'n_estimators': 200, 'max_depth': 7, 'learning_rate':
0.013295241456985386, 'subsample': 0.9256225084080685, 'colsample_bytree':
0.8267100221413478}. Best is trial 21 with value: 0.5418933623503809.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
```

```
    "learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
```

```
    "subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
```

```
    "colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:06:59] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.
```

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

```
[I 2024-12-03 22:06:59,756] Trial 27 finished with value: 0.5104166666666666 and
parameters: {'n_estimators': 150, 'max_depth': 6, 'learning_rate':
```

```

0.044961987475304714, 'subsample': 0.8360660065428324, 'colsample_bytree':
0.7905245807672153}. Best is trial 21 with value: 0.5418933623503809.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
    "learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
    "subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
    "colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:06:59] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.

```

```

    warnings.warn(smsg, UserWarning)
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/sklearn/metrics/_classification.py:1531:
UndefinedMetricWarning: Precision is ill-defined and being set to 0.0 due to no
predicted samples. Use `zero_division` parameter to control this behavior.
    _warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
[I 2024-12-03 22:07:00,258] Trial 28 finished with value: 0.0 and parameters:
{'n_estimators': 200, 'max_depth': 5, 'learning_rate': 6.167433114602635e-05,
'subsample': 0.8127508598657925, 'colsample_bytree': 0.8775740880274869}. Best
is trial 21 with value: 0.5418933623503809.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
    "learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
    "subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
    "colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:07:00] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.

```



```
warnings.warn(smsg, UserWarning)
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/sklearn/metrics/_classification.py:1531:
UndefinedMetricWarning: Precision is ill-defined and being set to 0.0 due to no
predicted samples. Use `zero_division` parameter to control this behavior.
    _warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
[I 2024-12-03 22:07:00,894] Trial 29 finished with value: 0.0 and parameters:
{'n_estimators': 150, 'max_depth': 7, 'learning_rate': 1.3269724419969594e-05,
'subsample': 0.7800064649838638, 'colsample_bytree': 0.8489481695343771}. Best
is trial 21 with value: 0.5418933623503809.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
    "learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
    "subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
    "colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:07:01] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.
```

```
warnings.warn(smsg, UserWarning)
[I 2024-12-03 22:07:01,641] Trial 30 finished with value: 0.4946492271105826 and
parameters: {'n_estimators': 200, 'max_depth': 6, 'learning_rate':
0.024524088889297795, 'subsample': 0.8672200129170672, 'colsample_bytree':
0.9226365110085404}. Best is trial 21 with value: 0.5418933623503809.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
    "learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
    "subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
    "colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:07:01] WARNING:
```

```
/workspace/src/learner.cc:740:  
Parameters: { "use_label_encoder" } are not used.
```

```
warnings.warn(msg, UserWarning)  
[I 2024-12-03 22:07:02,531] Trial 31 finished with value: 0.5253764640267707 and  
parameters: {'n_estimators': 150, 'max_depth': 8, 'learning_rate':  
0.04999368956956612, 'subsample': 0.8437988514013232, 'colsample_bytree':  
0.8761022890657644}. Best is trial 21 with value: 0.5418933623503809.  
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has  
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See  
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,  
log=True) instead.  
"learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),  
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been  
deprecated in v3.0.0. This feature will be removed in v6.0.0. See  
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.  
"subsample": trial.suggest_uniform("subsample", 0.7, 1.0),  
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been  
deprecated in v3.0.0. This feature will be removed in v6.0.0. See  
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.  
"colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),  
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.  
12/site-packages/xgboost/core.py:158: UserWarning: [22:07:02] WARNING:  
/workspace/src/learner.cc:740:  
Parameters: { "use_label_encoder" } are not used.
```

```
warnings.warn(msg, UserWarning)  
[I 2024-12-03 22:07:03,309] Trial 32 finished with value: 0.5275204359673025 and  
parameters: {'n_estimators': 150, 'max_depth': 9, 'learning_rate':  
0.06411461555093526, 'subsample': 0.9034480094615882, 'colsample_bytree':  
0.8876327663558711}. Best is trial 21 with value: 0.5418933623503809.  
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has  
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See  
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,  
log=True) instead.  
"learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),  
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been  
deprecated in v3.0.0. This feature will be removed in v6.0.0. See  
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.  
"subsample": trial.suggest_uniform("subsample", 0.7, 1.0),  
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been  
deprecated in v3.0.0. This feature will be removed in v6.0.0. See  
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.  
"colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),  
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.  
12/site-packages/xgboost/core.py:158: UserWarning: [22:07:03] WARNING:  
/workspace/src/learner.cc:740:  
Parameters: { "use_label_encoder" } are not used.
```

```
warnings.warn(smsg, UserWarning)
[I 2024-12-03 22:07:04,209] Trial 33 finished with value: 0.49740334679746107
and parameters: {'n_estimators': 150, 'max_depth': 9, 'learning_rate':
0.028142266238421556, 'subsample': 0.9064209592097502, 'colsample_bytree':
0.9472117858917467}. Best is trial 21 with value: 0.5418933623503809.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
    "learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
    "subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
    "colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:07:04] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.
```

```
warnings.warn(smsg, UserWarning)
[I 2024-12-03 22:07:04,766] Trial 34 finished with value: 0.5202890494719289 and
parameters: {'n_estimators': 100, 'max_depth': 10, 'learning_rate':
0.06094329393630046, 'subsample': 0.9342496586041588, 'colsample_bytree':
0.8890290787093179}. Best is trial 21 with value: 0.5418933623503809.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
    "learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
    "subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
    "colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:07:04] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.
```

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

```
[I 2024-12-03 22:07:05,964] Trial 35 finished with value: 0.34121863799283153
and parameters: {'n_estimators': 150, 'max_depth': 9, 'learning_rate':
0.0105173674861313, 'subsample': 0.8863470688103812, 'colsample_bytree':
0.9108668977767131}. Best is trial 21 with value: 0.5418933623503809.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
    "learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
    "subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
    "colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:07:06] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.
```

```
warnings.warn(smsg, UserWarning)
[I 2024-12-03 22:07:06,673] Trial 36 finished with value: 0.49737914967967384
and parameters: {'n_estimators': 200, 'max_depth': 8, 'learning_rate':
0.024920775740873004, 'subsample': 0.9543389071872175, 'colsample_bytree':
0.8354692153601055}. Best is trial 21 with value: 0.5418933623503809.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
    "learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
    "subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
    "colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:07:06] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.
```

```
warnings.warn(smsg, UserWarning)
[I 2024-12-03 22:07:07,023] Trial 37 finished with value: 0.514480408858603 and
parameters: {'n_estimators': 100, 'max_depth': 7, 'learning_rate':
```

```

0.0661129377030442, 'subsample': 0.906880567840552, 'colsample_bytree':
0.8078189606712485}. Best is trial 21 with value: 0.5418933623503809.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
    "learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
    "subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
    "colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:07:07] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.

```

```

warnings.warn(msg, UserWarning)
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/sklearn/metrics/_classification.py:1531:
UndefinedMetricWarning: Precision is ill-defined and being set to 0.0 due to no
predicted samples. Use `zero_division` parameter to control this behavior.
    _warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
[I 2024-12-03 22:07:07,795] Trial 38 finished with value: 0.0 and parameters:
{'n_estimators': 150, 'max_depth': 10, 'learning_rate': 0.0005069216935399924,
'subsample': 0.8230683544123615, 'colsample_bytree': 0.8595169139648354}. Best
is trial 21 with value: 0.5418933623503809.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
    "learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
    "subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
    "colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:07:07] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.

```

```
warnings.warn(msg, UserWarning)
[I 2024-12-03 22:07:08,240] Trial 39 finished with value: 0.44218551461245237
and parameters: {'n_estimators': 150, 'max_depth': 4, 'learning_rate':
0.031614812480480994, 'subsample': 0.8694530120364085, 'colsample_bytree':
0.9445166535791124}. Best is trial 21 with value: 0.5418933623503809.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
"learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:07:08] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.
```

```
warnings.warn(msg, UserWarning)
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/sklearn/metrics/_classification.py:1531:
UndefinedMetricWarning: Precision is ill-defined and being set to 0.0 due to no
predicted samples. Use `zero_division` parameter to control this behavior.
_warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
[I 2024-12-03 22:07:08,524] Trial 40 finished with value: 0.0 and parameters:
{'n_estimators': 100, 'max_depth': 5, 'learning_rate': 0.0031118865908309405,
'subsample': 0.9400498966347, 'colsample_bytree': 0.9804848649520951}. Best is
trial 21 with value: 0.5418933623503809.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
"learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:07:08] WARNING:
```

```
/workspace/src/learner.cc:740:  
Parameters: { "use_label_encoder" } are not used.
```

```
warnings.warn(msg, UserWarning)  
[I 2024-12-03 22:07:09,295] Trial 41 finished with value: 0.5149501661129569 and  
parameters: {'n_estimators': 150, 'max_depth': 9, 'learning_rate':  
0.05273177128501267, 'subsample': 0.8408053881005555, 'colsample_bytree':  
0.884404192325245}. Best is trial 21 with value: 0.5418933623503809.  
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has  
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See  
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,  
log=True) instead.  
"learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),  
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been  
deprecated in v3.0.0. This feature will be removed in v6.0.0. See  
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.  
"subsample": trial.suggest_uniform("subsample", 0.7, 1.0),  
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been  
deprecated in v3.0.0. This feature will be removed in v6.0.0. See  
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.  
"colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),  
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.  
12/site-packages/xgboost/core.py:158: UserWarning: [22:07:09] WARNING:  
/workspace/src/learner.cc:740:  
Parameters: { "use_label_encoder" } are not used.
```

```
warnings.warn(msg, UserWarning)  
[I 2024-12-03 22:07:09,870] Trial 42 finished with value: 0.5176211453744494 and  
parameters: {'n_estimators': 150, 'max_depth': 9, 'learning_rate':  
0.09315300243350572, 'subsample': 0.7667160833209614, 'colsample_bytree':  
0.8544749841129464}. Best is trial 21 with value: 0.5418933623503809.  
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has  
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See  
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,  
log=True) instead.  
"learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),  
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been  
deprecated in v3.0.0. This feature will be removed in v6.0.0. See  
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.  
"subsample": trial.suggest_uniform("subsample", 0.7, 1.0),  
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been  
deprecated in v3.0.0. This feature will be removed in v6.0.0. See  
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.  
"colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),  
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.  
12/site-packages/xgboost/core.py:158: UserWarning: [22:07:09] WARNING:  
/workspace/src/learner.cc:740:  
Parameters: { "use_label_encoder" } are not used.
```

```
warnings.warn(smsg, UserWarning)
[I 2024-12-03 22:07:10,983] Trial 43 finished with value: 0.42680546519193235
and parameters: {'n_estimators': 150, 'max_depth': 8, 'learning_rate':
0.018353756638973588, 'subsample': 0.7987411491071985, 'colsample_bytree':
0.7879953926870382}. Best is trial 21 with value: 0.5418933623503809.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
    "learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
    "subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
    "colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:07:11] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.
```

```
warnings.warn(smsg, UserWarning)
[I 2024-12-03 22:07:11,584] Trial 44 finished with value: 0.5091743119266054 and
parameters: {'n_estimators': 150, 'max_depth': 7, 'learning_rate':
0.0378324619598763, 'subsample': 0.8963581259834223, 'colsample_bytree':
0.9126593096845527}. Best is trial 21 with value: 0.5418933623503809.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
    "learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
    "subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
    "colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:07:11] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.
```

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



```
[I 2024-12-03 22:07:11,931] Trial 45 finished with value: 0.497348261638185 and
parameters: {'n_estimators': 100, 'max_depth': 6, 'learning_rate':
0.05243508035272527, 'subsample': 0.9207337134207632, 'colsample_bytree':
0.8351731573931476}. Best is trial 21 with value: 0.5418933623503809.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
```

```
"learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
```

```
"subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
```

```
"colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:07:12] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.
```

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

```
[I 2024-12-03 22:07:12,826] Trial 46 finished with value: 0.5275938189845475 and
parameters: {'n_estimators': 200, 'max_depth': 8, 'learning_rate':
0.06673538165814931, 'subsample': 0.7254710457002123, 'colsample_bytree':
0.7342680961891901}. Best is trial 21 with value: 0.5418933623503809.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
```

```
"learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
```

```
"subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
```

```
"colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:07:12] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.
```

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

```
[I 2024-12-03 22:07:13,509] Trial 47 finished with value: 0.5307692307692308 and
parameters: {'n_estimators': 200, 'max_depth': 6, 'learning_rate':
```

```

0.06974554037826429, 'subsample': 0.7280506980115274, 'colsample_bytree':
0.7248243492252133}. Best is trial 21 with value: 0.5418933623503809.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
    "learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
    "subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
    "colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:07:13] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.

```

```

warnings.warn(msg, UserWarning)
[I 2024-12-03 22:07:14,002] Trial 48 finished with value: 0.5348583877995643 and
parameters: {'n_estimators': 200, 'max_depth': 6, 'learning_rate':
0.09034392290737775, 'subsample': 0.7291378721810432, 'colsample_bytree':
0.7219305121066734}. Best is trial 21 with value: 0.5418933623503809.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
    "learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
    "subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
    "colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:07:14] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.

```

```

warnings.warn(msg, UserWarning)
[I 2024-12-03 22:07:14,671] Trial 49 finished with value: 0.31946508172362553
and parameters: {'n_estimators': 200, 'max_depth': 6, 'learning_rate':
0.010071745579610204, 'subsample': 0.7563611492342431, 'colsample_bytree':
0.710265049306126}. Best is trial 21 with value: 0.5418933623503809.

```

```

/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
    "learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
    "subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
    "colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:07:14] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.

```

```

warnings.warn(msg, UserWarning)
[I 2024-12-03 22:07:15,145] Trial 50 finished with value: 0.2200488997555012 and
parameters: {'n_estimators': 200, 'max_depth': 5, 'learning_rate':
0.0061314598026833075, 'subsample': 0.7290347331791422, 'colsample_bytree':
0.7382108064432171}. Best is trial 21 with value: 0.5418933623503809.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
    "learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
    "subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
    "colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:07:15] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.

```

```

warnings.warn(msg, UserWarning)
[I 2024-12-03 22:07:15,723] Trial 51 finished with value: 0.5456509994597515 and
parameters: {'n_estimators': 200, 'max_depth': 6, 'learning_rate':
0.09868633501704607, 'subsample': 0.7236804680452364, 'colsample_bytree':
0.7355496841213632}. Best is trial 51 with value: 0.5456509994597515.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See

```

```

https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
  "learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
  "subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
  "colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:07:15] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.

```

```

warnings.warn(smsg, UserWarning)
[I 2024-12-03 22:07:16,372] Trial 52 finished with value: 0.5340599455040872 and
parameters: {'n_estimators': 200, 'max_depth': 6, 'learning_rate':
0.09902904509395409, 'subsample': 0.7250218779379729, 'colsample_bytree':
0.7175766948247206}. Best is trial 51 with value: 0.5456509994597515.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
  "learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
  "subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
  "colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:07:16] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.

```

```

warnings.warn(smsg, UserWarning)
[I 2024-12-03 22:07:17,053] Trial 53 finished with value: 0.5335533553355336 and
parameters: {'n_estimators': 200, 'max_depth': 6, 'learning_rate':
0.08394523449684632, 'subsample': 0.7636838301932687, 'colsample_bytree':
0.7571861428020473}. Best is trial 51 with value: 0.5456509994597515.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.

```

```

"learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:07:17] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.

```

```

warnings.warn(msg, UserWarning)
[I 2024-12-03 22:07:17,642] Trial 54 finished with value: 0.509090909090909 and
parameters: {'n_estimators': 200, 'max_depth': 7, 'learning_rate':
0.03520012330372935, 'subsample': 0.7192486055914825, 'colsample_bytree':
0.7000182280390684}. Best is trial 51 with value: 0.5456509994597515.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.

```

```

"learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:07:17] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.

```

```

warnings.warn(msg, UserWarning)
[I 2024-12-03 22:07:18,303] Trial 55 finished with value: 0.5214050493962679 and
parameters: {'n_estimators': 200, 'max_depth': 5, 'learning_rate':
0.0998365013852751, 'subsample': 0.747418862102736, 'colsample_bytree':
0.7540615400409405}. Best is trial 51 with value: 0.5456509994597515.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.

```

```

"learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been

```

deprecated in v3.0.0. This feature will be removed in v6.0.0. See <https://github.com/optuna/optuna/releases/tag/v3.0.0>. Use suggest_float instead.

```
"subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
```

/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been deprecated in v3.0.0. This feature will be removed in v6.0.0. See <https://github.com/optuna/optuna/releases/tag/v3.0.0>. Use suggest_float instead.

```
"colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
```

/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.12/site-packages/xgboost/core.py:158: UserWarning: [22:07:18] WARNING: /workspace/src/learner.cc:740: Parameters: { "use_label_encoder" } are not used.

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

/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.12/site-packages/sklearn/metrics/_classification.py:1531: UndefinedMetricWarning: Precision is ill-defined and being set to 0.0 due to no predicted samples. Use `zero_division` parameter to control this behavior.

```
_warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
```

[I 2024-12-03 22:07:18,983] Trial 56 finished with value: 0.0 and parameters: {'n_estimators': 200, 'max_depth': 6, 'learning_rate': 0.0014021617173343942, 'subsample': 0.7628637604300661, 'colsample_bytree': 0.7766726341566859}. Best is trial 51 with value: 0.5456509994597515.

/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has been deprecated in v3.0.0. This feature will be removed in v6.0.0. See <https://github.com/optuna/optuna/releases/tag/v3.0.0>. Use suggest_float(..., log=True) instead.

```
"learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
```

/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been deprecated in v3.0.0. This feature will be removed in v6.0.0. See <https://github.com/optuna/optuna/releases/tag/v3.0.0>. Use suggest_float instead.

```
"subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
```

/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been deprecated in v3.0.0. This feature will be removed in v6.0.0. See <https://github.com/optuna/optuna/releases/tag/v3.0.0>. Use suggest_float instead.

```
"colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
```

/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.12/site-packages/xgboost/core.py:158: UserWarning: [22:07:19] WARNING: /workspace/src/learner.cc:740: Parameters: { "use_label_encoder" } are not used.

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

[I 2024-12-03 22:07:19,467] Trial 57 finished with value: 0.47384615384615386 and parameters: {'n_estimators': 200, 'max_depth': 6, 'learning_rate': 0.020536008228637482, 'subsample': 0.7156563474989235, 'colsample_bytree': 0.7465690189313394}. Best is trial 51 with value: 0.5456509994597515.

/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has been deprecated in v3.0.0. This feature will be removed in v6.0.0. See <https://github.com/optuna/optuna/releases/tag/v3.0.0>. Use suggest_float(...,

```
log=True) instead.
"learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:07:19] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.
```

```
warnings.warn(msg, UserWarning)
[I 2024-12-03 22:07:20,116] Trial 58 finished with value: 0.5077010838562465 and
parameters: {'n_estimators': 200, 'max_depth': 7, 'learning_rate':
0.032877693200043696, 'subsample': 0.7378708876764843, 'colsample_bytree':
0.7166700248525325}. Best is trial 51 with value: 0.5456509994597515.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
```

```
"learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:07:20] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.
```

```
warnings.warn(msg, UserWarning)
[I 2024-12-03 22:07:20,600] Trial 59 finished with value: 0.525207756232687 and
parameters: {'n_estimators': 200, 'max_depth': 5, 'learning_rate':
0.08162539340664986, 'subsample': 0.7030294852987448, 'colsample_bytree':
0.7694171945543056}. Best is trial 51 with value: 0.5456509994597515.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
```

```
"learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
```

```

/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
    "subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
    "colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:07:20] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.

```

```

    warnings.warn(msg, UserWarning)
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/sklearn/metrics/_classification.py:1531:
UndefinedMetricWarning: Precision is ill-defined and being set to 0.0 due to no
predicted samples. Use `zero_division` parameter to control this behavior.
    _warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
[I 2024-12-03 22:07:21,118] Trial 60 finished with value: 0.0 and parameters:
{'n_estimators': 200, 'max_depth': 6, 'learning_rate': 5.854018887199057e-05,
'subsample': 0.7361191734957364, 'colsample_bytree': 0.724925404154508}. Best is
trial 51 with value: 0.5456509994597515.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
    "learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
    "subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
    "colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:07:21] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.

```

```

    warnings.warn(msg, UserWarning)
[I 2024-12-03 22:07:21,676] Trial 61 finished with value: 0.530093870789619 and
parameters: {'n_estimators': 200, 'max_depth': 6, 'learning_rate':
0.0710706354314767, 'subsample': 0.7509843991245135, 'colsample_bytree':
0.7404473684993703}. Best is trial 51 with value: 0.5456509994597515.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See

```



```

https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
"learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:07:21] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.

```

```

warnings.warn(smsg, UserWarning)
[I 2024-12-03 22:07:22,133] Trial 62 finished with value: 0.5186020293122886 and
parameters: {'n_estimators': 200, 'max_depth': 6, 'learning_rate':
0.04392595033913789, 'subsample': 0.7700038229170376, 'colsample_bytree':
0.716234497773428}. Best is trial 51 with value: 0.5456509994597515.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
"learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:07:22] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.

```

```

warnings.warn(smsg, UserWarning)
[I 2024-12-03 22:07:22,379] Trial 63 finished with value: 0.48197115384615385
and parameters: {'n_estimators': 50, 'max_depth': 6, 'learning_rate':
0.09438937620582939, 'subsample': 0.7870327693071778, 'colsample_bytree':
0.7606415183189315}. Best is trial 51 with value: 0.5456509994597515.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.

```

```
"learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:07:22] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.
```

```
warnings.warn(msg, UserWarning)
[I 2024-12-03 22:07:23,258] Trial 64 finished with value: 0.5292792792792793 and
parameters: {'n_estimators': 200, 'max_depth': 7, 'learning_rate':
0.048786391408548055, 'subsample': 0.7122528421216513, 'colsample_bytree':
0.8000996959230184}. Best is trial 51 with value: 0.5456509994597515.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
```

```
"learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:07:23] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.
```

```
warnings.warn(msg, UserWarning)
[I 2024-12-03 22:07:23,694] Trial 65 finished with value: 0.5301204819277109 and
parameters: {'n_estimators': 200, 'max_depth': 5, 'learning_rate':
0.09735264615160423, 'subsample': 0.733795052954057, 'colsample_bytree':
0.7497891991334241}. Best is trial 51 with value: 0.5456509994597515.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
```

```
"learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
```

deprecated in v3.0.0. This feature will be removed in v6.0.0. See
<https://github.com/optuna/optuna/releases/tag/v3.0.0>. Use suggest_float instead.
 "subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
 /tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
 deprecated in v3.0.0. This feature will be removed in v6.0.0. See
<https://github.com/optuna/optuna/releases/tag/v3.0.0>. Use suggest_float instead.
 "colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
 /home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
 12/site-packages/xgboost/core.py:158: UserWarning: [22:07:23] WARNING:
 /workspace/src/learner.cc:740:
 Parameters: { "use_label_encoder" } are not used.

warnings.warn(smsg, UserWarning)
 [I 2024-12-03 22:07:24,402] Trial 66 finished with value: 0.5374931581828134 and
 parameters: {'n_estimators': 200, 'max_depth': 6, 'learning_rate':
 0.07024954867508294, 'subsample': 0.7212459035230092, 'colsample_bytree':
 0.7294122455897714}. Best is trial 51 with value: 0.5456509994597515.
 /tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
 been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
<https://github.com/optuna/optuna/releases/tag/v3.0.0>. Use suggest_float(...,
 log=True) instead.
 "learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
 /tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
 deprecated in v3.0.0. This feature will be removed in v6.0.0. See
<https://github.com/optuna/optuna/releases/tag/v3.0.0>. Use suggest_float instead.
 "subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
 /tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
 deprecated in v3.0.0. This feature will be removed in v6.0.0. See
<https://github.com/optuna/optuna/releases/tag/v3.0.0>. Use suggest_float instead.
 "colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
 /home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
 12/site-packages/xgboost/core.py:158: UserWarning: [22:07:24] WARNING:
 /workspace/src/learner.cc:740:
 Parameters: { "use_label_encoder" } are not used.

warnings.warn(smsg, UserWarning)
 [I 2024-12-03 22:07:24,936] Trial 67 finished with value: 0.5249169435215947 and
 parameters: {'n_estimators': 200, 'max_depth': 6, 'learning_rate':
 0.060562971668044266, 'subsample': 0.7221150160270281, 'colsample_bytree':
 0.7278001511423711}. Best is trial 51 with value: 0.5456509994597515.
 /tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
 been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
<https://github.com/optuna/optuna/releases/tag/v3.0.0>. Use suggest_float(...,
 log=True) instead.
 "learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
 /tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
 deprecated in v3.0.0. This feature will be removed in v6.0.0. See
<https://github.com/optuna/optuna/releases/tag/v3.0.0>. Use suggest_float instead.

```
"subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:07:25] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.
```

```
warnings.warn(msg, UserWarning)
[I 2024-12-03 22:07:25,511] Trial 68 finished with value: 0.39541160593792174
and parameters: {'n_estimators': 200, 'max_depth': 5, 'learning_rate':
0.015693371936821694, 'subsample': 0.7005629431373903, 'colsample_bytree':
0.7120377356080422}. Best is trial 51 with value: 0.5456509994597515.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
"learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:07:25] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.
```

```
warnings.warn(msg, UserWarning)
[I 2024-12-03 22:07:26,171] Trial 69 finished with value: 0.500865551067513 and
parameters: {'n_estimators': 200, 'max_depth': 7, 'learning_rate':
0.02775308230297092, 'subsample': 0.7431124771962043, 'colsample_bytree':
0.7766583325881787}. Best is trial 51 with value: 0.5456509994597515.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
"learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
```

deprecated in v3.0.0. This feature will be removed in v6.0.0. See <https://github.com/optuna/optuna/releases/tag/v3.0.0>. Use suggest_float instead.

```
"colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
```

/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.12/site-packages/xgboost/core.py:158: UserWarning: [22:07:26] WARNING: /workspace/src/learner.cc:740: Parameters: { "use_label_encoder" } are not used.

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

[I 2024-12-03 22:07:26,655] Trial 70 finished with value: 0.5229722064662508 and parameters: {'n_estimators': 200, 'max_depth': 6, 'learning_rate': 0.03754078203676732, 'subsample': 0.760227244850386, 'colsample_bytree': 0.7453852250291109}. Best is trial 51 with value: 0.5456509994597515.

/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has been deprecated in v3.0.0. This feature will be removed in v6.0.0. See <https://github.com/optuna/optuna/releases/tag/v3.0.0>. Use suggest_float(..., log=True) instead.

```
"learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
```

/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been deprecated in v3.0.0. This feature will be removed in v6.0.0. See <https://github.com/optuna/optuna/releases/tag/v3.0.0>. Use suggest_float instead.

```
"subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
```

/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been deprecated in v3.0.0. This feature will be removed in v6.0.0. See <https://github.com/optuna/optuna/releases/tag/v3.0.0>. Use suggest_float instead.

```
"colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
```

/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.12/site-packages/xgboost/core.py:158: UserWarning: [22:07:26] WARNING: /workspace/src/learner.cc:740: Parameters: { "use_label_encoder" } are not used.

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

[I 2024-12-03 22:07:27,243] Trial 71 finished with value: 0.5276409414340448 and parameters: {'n_estimators': 200, 'max_depth': 6, 'learning_rate': 0.08164703127789925, 'subsample': 0.7115121164104462, 'colsample_bytree': 0.7318870527323623}. Best is trial 51 with value: 0.5456509994597515.

/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has been deprecated in v3.0.0. This feature will be removed in v6.0.0. See <https://github.com/optuna/optuna/releases/tag/v3.0.0>. Use suggest_float(..., log=True) instead.

```
"learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
```

/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been deprecated in v3.0.0. This feature will be removed in v6.0.0. See <https://github.com/optuna/optuna/releases/tag/v3.0.0>. Use suggest_float instead.

```
"subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
```

/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been deprecated in v3.0.0. This feature will be removed in v6.0.0. See <https://github.com/optuna/optuna/releases/tag/v3.0.0>. Use suggest_float instead.

```
"colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:07:27] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.
```

```
warnings.warn(msg, UserWarning)
[I 2024-12-03 22:07:27,735] Trial 72 finished with value: 0.525096525096525 and
parameters: {'n_estimators': 200, 'max_depth': 6, 'learning_rate':
0.07051592283255592, 'subsample': 0.7740448090958537, 'colsample_bytree':
0.8163614957282449}. Best is trial 51 with value: 0.5456509994597515.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
"learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:07:27] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.
```

```
warnings.warn(msg, UserWarning)
[I 2024-12-03 22:07:29,406] Trial 73 finished with value: 0.5150501672240803 and
parameters: {'n_estimators': 200, 'max_depth': 7, 'learning_rate':
0.05353617414743175, 'subsample': 0.7497847593099378, 'colsample_bytree':
0.705927006712444}. Best is trial 51 with value: 0.5456509994597515.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
"learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
```

```
12/site-packages/xgboost/core.py:158: UserWarning: [22:07:29] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.
```

```
warnings.warn(smsg, UserWarning)
[I 2024-12-03 22:07:29,863] Trial 74 finished with value: 0.5112781954887218 and
parameters: {'n_estimators': 200, 'max_depth': 5, 'learning_rate':
0.04168727746168797, 'subsample': 0.7204352857013447, 'colsample_bytree':
0.7189002272221114}. Best is trial 51 with value: 0.5456509994597515.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
"learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:07:29] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.
```

```
warnings.warn(smsg, UserWarning)
[I 2024-12-03 22:07:30,364] Trial 75 finished with value: 0.5337690631808278 and
parameters: {'n_estimators': 200, 'max_depth': 6, 'learning_rate':
0.07688391878599278, 'subsample': 0.7316854485147365, 'colsample_bytree':
0.76117738488884}. Best is trial 51 with value: 0.5456509994597515.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
"learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:07:30] WARNING:
/workspace/src/learner.cc:740:
```

Parameters: { "use_label_encoder" } are not used.

```
warnings.warn(smsg, UserWarning)
[I 2024-12-03 22:07:30,950] Trial 76 finished with value: 0.5283434232250963 and
parameters: {'n_estimators': 200, 'max_depth': 6, 'learning_rate':
0.07864825457817658, 'subsample': 0.73388634367301, 'colsample_bytree':
0.7599934635187927}. Best is trial 51 with value: 0.5456509994597515.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
"learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:07:31] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.
```

```
warnings.warn(smsg, UserWarning)
[I 2024-12-03 22:07:31,892] Trial 77 finished with value: 0.5197112715158245 and
parameters: {'n_estimators': 200, 'max_depth': 6, 'learning_rate':
0.055042537735385304, 'subsample': 0.7423820591289158, 'colsample_bytree':
0.7674513827825082}. Best is trial 51 with value: 0.5456509994597515.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
"learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:07:31] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.
```



```
warnings.warn(msg, UserWarning)
[I 2024-12-03 22:07:32,368] Trial 78 finished with value: 0.4625 and parameters:
{'n_estimators': 200, 'max_depth': 5, 'learning_rate': 0.023738868951795968,
'subsample': 0.9731523142574322, 'colsample_bytree': 0.7544194076879446}. Best
is trial 51 with value: 0.5456509994597515.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
"learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:07:32] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.
```

```
warnings.warn(msg, UserWarning)
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/sklearn/metrics/_classification.py:1531:
UndefinedMetricWarning: Precision is ill-defined and being set to 0.0 due to no
predicted samples. Use `zero_division` parameter to control this behavior.
_warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
[I 2024-12-03 22:07:32,763] Trial 79 finished with value: 0.0 and parameters:
{'n_estimators': 50, 'max_depth': 7, 'learning_rate': 0.0006891050945145027,
'subsample': 0.7090501373478557, 'colsample_bytree': 0.7865290835350544}. Best
is trial 51 with value: 0.5456509994597515.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
"learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:07:32] WARNING:
```

```
/workspace/src/learner.cc:740:  
Parameters: { "use_label_encoder" } are not used.
```

```
warnings.warn(msg, UserWarning)  
[I 2024-12-03 22:07:33,406] Trial 80 finished with value: 0.506993006993007 and  
parameters: {'n_estimators': 200, 'max_depth': 6, 'learning_rate':  
0.031615900121174836, 'subsample': 0.7883420073405715, 'colsample_bytree':  
0.7356665371068747}. Best is trial 51 with value: 0.5456509994597515.  
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has  
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See  
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,  
log=True) instead.  
"learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),  
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been  
deprecated in v3.0.0. This feature will be removed in v6.0.0. See  
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.  
"subsample": trial.suggest_uniform("subsample", 0.7, 1.0),  
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been  
deprecated in v3.0.0. This feature will be removed in v6.0.0. See  
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.  
"colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),  
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.  
12/site-packages/xgboost/core.py:158: UserWarning: [22:07:33] WARNING:  
/workspace/src/learner.cc:740:  
Parameters: { "use_label_encoder" } are not used.
```

```
warnings.warn(msg, UserWarning)  
[I 2024-12-03 22:07:34,034] Trial 81 finished with value: 0.5150166852057843 and  
parameters: {'n_estimators': 200, 'max_depth': 6, 'learning_rate':  
0.06230615606290961, 'subsample': 0.7264394893284013, 'colsample_bytree':  
0.8993881802076508}. Best is trial 51 with value: 0.5456509994597515.  
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has  
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See  
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,  
log=True) instead.  
"learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),  
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been  
deprecated in v3.0.0. This feature will be removed in v6.0.0. See  
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.  
"subsample": trial.suggest_uniform("subsample", 0.7, 1.0),  
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been  
deprecated in v3.0.0. This feature will be removed in v6.0.0. See  
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.  
"colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),  
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.  
12/site-packages/xgboost/core.py:158: UserWarning: [22:07:34] WARNING:  
/workspace/src/learner.cc:740:  
Parameters: { "use_label_encoder" } are not used.
```

```
warnings.warn(smsg, UserWarning)
[I 2024-12-03 22:07:34,774] Trial 82 finished with value: 0.5241228070175439 and
parameters: {'n_estimators': 200, 'max_depth': 6, 'learning_rate':
0.08052643449676605, 'subsample': 0.8263703299595266, 'colsample_bytree':
0.7420696934484275}. Best is trial 51 with value: 0.5456509994597515.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
"learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:07:34] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.
```

```
warnings.warn(smsg, UserWarning)
[I 2024-12-03 22:07:35,324] Trial 83 finished with value: 0.5243568691844553 and
parameters: {'n_estimators': 150, 'max_depth': 6, 'learning_rate':
0.09619075524207292, 'subsample': 0.8530936334745012, 'colsample_bytree':
0.7237693752332667}. Best is trial 51 with value: 0.5456509994597515.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
"learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:07:35] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.
```

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

```
[I 2024-12-03 22:07:36,003] Trial 84 finished with value: 0.5178875638841567 and
parameters: {'n_estimators': 200, 'max_depth': 5, 'learning_rate':
0.04383376525009758, 'subsample': 0.7174594368415104, 'colsample_bytree':
0.9360809364317717}. Best is trial 51 with value: 0.5456509994597515.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
```

```
"learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
```

```
"subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
```

```
"colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:07:36] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.
```

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

```
[I 2024-12-03 22:07:36,593] Trial 85 finished with value: 0.5238362310712282 and
parameters: {'n_estimators': 150, 'max_depth': 6, 'learning_rate':
0.05906797359229864, 'subsample': 0.7304514146508658, 'colsample_bytree':
0.8627856451333238}. Best is trial 51 with value: 0.5456509994597515.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
```

```
"learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
```

```
"subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
```

```
"colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:07:36] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.
```

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

```
[I 2024-12-03 22:07:37,619] Trial 86 finished with value: 0.5414185165132648 and
parameters: {'n_estimators': 200, 'max_depth': 7, 'learning_rate':
```

```

0.07807340494515873, 'subsample': 0.8105662590764972, 'colsample_bytree':
0.960502905459858}. Best is trial 51 with value: 0.5456509994597515.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
    "learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
    "subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
    "colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:07:37] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.

```

```

warnings.warn(smsg, UserWarning)
[I 2024-12-03 22:07:38,616] Trial 87 finished with value: 0.5411255411255411 and
parameters: {'n_estimators': 200, 'max_depth': 7, 'learning_rate':
0.07604080757545176, 'subsample': 0.8023484669287724, 'colsample_bytree':
0.9576378184908884}. Best is trial 51 with value: 0.5456509994597515.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
    "learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
    "subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
    "colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:07:38] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.

```

```

warnings.warn(smsg, UserWarning)
[I 2024-12-03 22:07:39,531] Trial 88 finished with value: 0.522075055187638 and
parameters: {'n_estimators': 200, 'max_depth': 7, 'learning_rate':
0.04111019553839795, 'subsample': 0.7538167636615235, 'colsample_bytree':
0.9680324724874267}. Best is trial 51 with value: 0.5456509994597515.

```

```

/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
    "learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
    "subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
    "colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:07:39] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.

```

```

warnings.warn(msg, UserWarning)
[I 2024-12-03 22:07:40,328] Trial 89 finished with value: 0.5274009766684753 and
parameters: {'n_estimators': 200, 'max_depth': 7, 'learning_rate':
0.07095934172093218, 'subsample': 0.8099816853498131, 'colsample_bytree':
0.9559320336561852}. Best is trial 51 with value: 0.5456509994597515.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
    "learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
    "subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
    "colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:07:40] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.

```

```

warnings.warn(msg, UserWarning)
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/sklearn/metrics/_classification.py:1531:
UndefinedMetricWarning: Precision is ill-defined and being set to 0.0 due to no
predicted samples. Use `zero_division` parameter to control this behavior.
    _warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
[I 2024-12-03 22:07:42,112] Trial 90 finished with value: 0.0 and parameters:

```

```
{'n_estimators': 200, 'max_depth': 7, 'learning_rate': 0.0002610529382564352,
'subsample': 0.7982506622730762, 'colsample_bytree': 0.9811050339437332}. Best
is trial 51 with value: 0.5456509994597515.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
"learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:07:42] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.

warnings.warn(smsg, UserWarning)
[I 2024-12-03 22:07:42,773] Trial 91 finished with value: 0.532249322493225 and
parameters: {'n_estimators': 200, 'max_depth': 7, 'learning_rate':
0.07807767748258464, 'subsample': 0.8117233996101858, 'colsample_bytree':
0.9566926510266252}. Best is trial 51 with value: 0.5456509994597515.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
"learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:07:42] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.

warnings.warn(smsg, UserWarning)
[I 2024-12-03 22:07:43,371] Trial 92 finished with value: 0.5336249316566429 and
parameters: {'n_estimators': 200, 'max_depth': 7, 'learning_rate':
0.05129145268390644, 'subsample': 0.7577534067061562, 'colsample_bytree':
```

```

0.9993645955929201}. Best is trial 51 with value: 0.5456509994597515.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
"learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:07:43] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.

```

```

warnings.warn(msg, UserWarning)
[I 2024-12-03 22:07:43,990] Trial 93 finished with value: 0.5387131952017448 and
parameters: {'n_estimators': 200, 'max_depth': 7, 'learning_rate':
0.04839231055133933, 'subsample': 0.7409806742462274, 'colsample_bytree':
0.9895741321550546}. Best is trial 51 with value: 0.5456509994597515.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
"learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:07:44] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.

```

```

warnings.warn(msg, UserWarning)
[I 2024-12-03 22:07:44,673] Trial 94 finished with value: 0.5398706896551724 and
parameters: {'n_estimators': 200, 'max_depth': 7, 'learning_rate':
0.06227932190001218, 'subsample': 0.7399634717511127, 'colsample_bytree':
0.983533694002924}. Best is trial 51 with value: 0.5456509994597515.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has

```



```

been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
"learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:07:44] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.

```

```

warnings.warn(msg, UserWarning)
[I 2024-12-03 22:07:45,397] Trial 95 finished with value: 0.5217391304347826 and
parameters: {'n_estimators': 200, 'max_depth': 8, 'learning_rate':
0.03064003686837298, 'subsample': 0.7400429577405018, 'colsample_bytree':
0.9796404973576343}. Best is trial 51 with value: 0.5456509994597515.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
"learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:07:45] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.

```

```

warnings.warn(msg, UserWarning)
[I 2024-12-03 22:07:46,041] Trial 96 finished with value: 0.5277015907844212 and
parameters: {'n_estimators': 200, 'max_depth': 7, 'learning_rate':
0.05990621342779863, 'subsample': 0.7067588668504846, 'colsample_bytree':
0.9917470262138613}. Best is trial 51 with value: 0.5456509994597515.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,

```

```
log=True) instead.
"learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:07:46] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.
```

```
warnings.warn(msg, UserWarning)
[I 2024-12-03 22:07:46,720] Trial 97 finished with value: 0.5212589729431254 and
parameters: {'n_estimators': 200, 'max_depth': 7, 'learning_rate':
0.04742703087055088, 'subsample': 0.7796754950595608, 'colsample_bytree':
0.9752762126308473}. Best is trial 51 with value: 0.5456509994597515.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
```

```
"learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
"colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:07:46] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.
```

```
warnings.warn(msg, UserWarning)
[I 2024-12-03 22:07:47,307] Trial 98 finished with value: 0.4919976289270895 and
parameters: {'n_estimators': 200, 'max_depth': 7, 'learning_rate':
0.01921895497348277, 'subsample': 0.7459358252309898, 'colsample_bytree':
0.9631667824333929}. Best is trial 51 with value: 0.5456509994597515.
/tmp/ipykernel_30831/3014267607.py:12: FutureWarning: suggest_loguniform has
been deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float(...,
log=True) instead.
```

```
"learning_rate": trial.suggest_loguniform("learning_rate", 1e-5, 0.1),
```

```

/tmp/ipykernel_30831/3014267607.py:13: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
    "subsample": trial.suggest_uniform("subsample", 0.7, 1.0),
/tmp/ipykernel_30831/3014267607.py:14: FutureWarning: suggest_uniform has been
deprecated in v3.0.0. This feature will be removed in v6.0.0. See
https://github.com/optuna/optuna/releases/tag/v3.0.0. Use suggest_float instead.
    "colsample_bytree": trial.suggest_uniform("colsample_bytree", 0.7, 1.0),
/home/aaron/final_project_csca5622/csca5622_final_project/.finalenv/lib/python3.
12/site-packages/xgboost/core.py:158: UserWarning: [22:07:47] WARNING:
/workspace/src/learner.cc:740:
Parameters: { "use_label_encoder" } are not used.

```

```

warnings.warn(smsg, UserWarning)
[I 2024-12-03 22:07:48,019] Trial 99 finished with value: 0.5339858618814574 and
parameters: {'n_estimators': 200, 'max_depth': 8, 'learning_rate':
0.06550398796762741, 'subsample': 0.7223281793141294, 'colsample_bytree':
0.9882441623562805}. Best is trial 51 with value: 0.5456509994597515.

Best hyperparameters found: {'n_estimators': 200, 'max_depth': 6,
'learning_rate': 0.09868633501704607, 'subsample': 0.7236804680452364,
'colsample_bytree': 0.7355496841213632}

```

```

Evaluation Metrics:
Accuracy: 0.9070
Precision: 0.6368
Recall: 0.4773
F1-Score: 0.5457
AUC-ROC: 0.9287

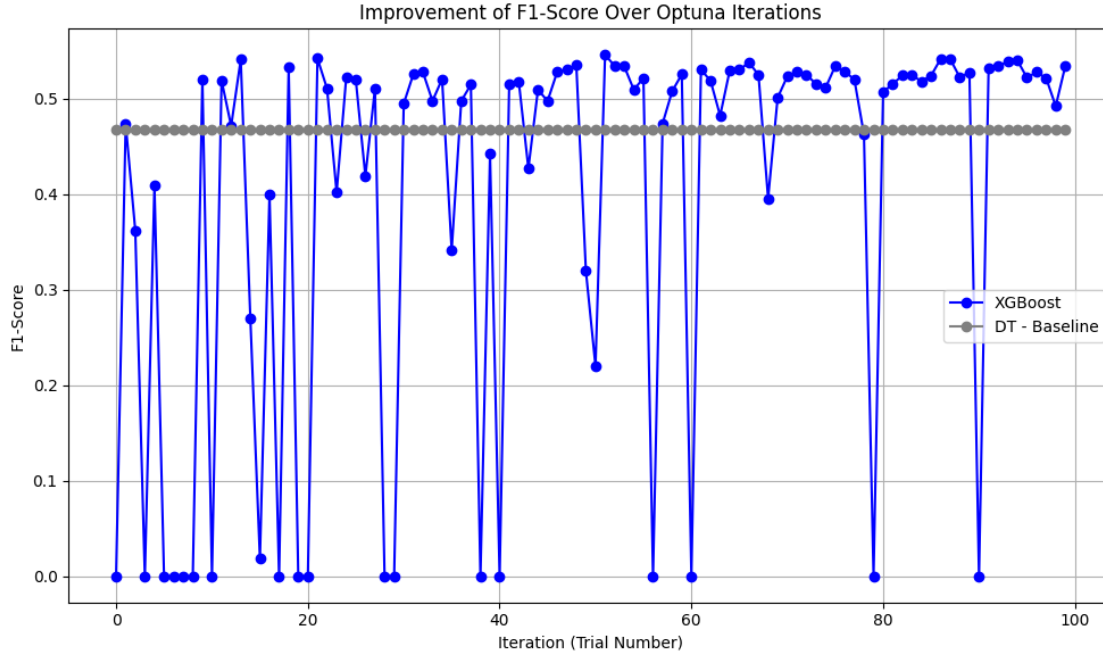
```

```

[12]: trial_results = study.trials_dataframe()
      # Plot the improvement of the F1-score over the iterations
      plt.figure(figsize=(10, 6))
      plt.plot(trial_results['number'], trial_results['value'], marker='o',
               linestyle='-', color='b', label='XGBoost')
      plt.plot(trial_results['number'], 0.4680*np.
               ones(len(trial_results['number'])), marker='o', linestyle='-',
               color='gray', label='DT - Baseline')
      # Add labels and title
      plt.xlabel('Iteration (Trial Number)')
      plt.ylabel('F1-Score')
      plt.title('Improvement of F1-Score Over Optuna Iterations')
      plt.grid(True)

      # Display the plot
      plt.tight_layout()
      plt.legend()
      plt.show()

```



1.3.3 Best Hyperparameters:

The best hyperparameters found by the Bayesian optimization are:

- **n_estimators = 200:** The model uses 200 boosting rounds (trees)
- **max_depth = 6:** Trees have a maximum depth of 6, controlling the complexity of the model.
- **learning_rate = 0.0986:** A moderate learning rate is chosen, balancing between fast convergence and overfitting.
- **subsample = 0.7236:** About 72.36% of the training data is used for each tree, helping prevent overfitting.
- **colsample_bytree = 0.73554:** 73.55% of the features are used per tree, adding regularization.

1.3.4 Evaluation metrics:

- **Accuracy:** 0.9070 — The model correctly predicts approximately 90.70% of the test samples.
- **Precision:** 0.6368 — About 63.68% of the positive predictions are actually correct. This suggests that the model has a good precision for identifying positive class instances.
- **Recall:** 0.4773 — The model is able to capture about 47.73% of the actual positive instances. This indicates some room for improvement in identifying all relevant positive cases.
- **F1-Score:** 0.5457 — The harmonic mean of precision and recall, indicating a balance between the two metrics. While it's above average, there's still room for optimization.
- **AUC-ROC:** 0.9287 — The area under the Receiver Operating Characteristic curve is high, indicating that the model has a strong ability to distinguish between the positive and negative classes.

1.3.5 Conclusion

- **Model Performance:** The XGBoost model with the optimized hyperparameters provides a strong performance, with an AUC-ROC of 0.9283, indicating it has good discriminative power between classes. The F1-Score of 0.5388 suggests that while the model is doing reasonably well, there might still be room for improvement, especially in terms of recall, which is lower compared to precision.
- **Potential Areas for Improvement:**
 - **Recall:** The model's recall is moderate, meaning it may be missing some relevant positive instances. You could experiment with adjusting the classification threshold or focus on improving recall by using techniques like oversampling, undersampling, or further tuning hyperparameters related to regularization.
 - **Feature Engineering:** Further improvement in feature selection or engineering could enhance model performance.
 - **Other Models:** You might want to compare the XGBoost results with other models, like Random Forest or Logistic Regression, to see if the improvement in AUC-ROC and F1-Score is significant or if another model outperforms XGBoost in this particular case.

1.3.6 Final Thoughts:

Overall, the Bayesian optimization approach helped in tuning the model for better performance. However, depending on the specific goal of the classification (e.g., minimizing false positives vs. false negatives), you may want to experiment with further optimization, model types, or thresholds.

If your goal is to maximize recall for the positive class (perhaps in fraud detection or medical diagnosis), you can further adjust the model to prioritize recall. If you're optimizing for precision (minimizing false positives), the model is already performing quite well.