

classifier__parameter

September 5, 2025

1 Analysis and Evaluation of Classification Models

This notebook aims to explore and compare the performance of different machine learning models for a classification problem. The main objectives are:

1. **Evaluate baseline models:** Analyze the performance of classifiers such as **Logistic Regression**, **Random Forest**, and **XGBoost** using the entire feature set.
2. **Perform feature selection:** Identify and use the 10 most relevant features to retrain the models, with the goal of improving efficiency and performance.
3. **Optimize parameters:** Find the best hyperparameters for each model using optimization techniques.
4. **Build and evaluate an ensemble:** Combine the optimized models into a **VotingClassifier** to leverage the collective strength of different algorithms and achieve more robust results.

Each section of the notebook is dedicated to a specific model, with charts and reports that document the different evaluation phases.

1.1 1) Setup and initialization

```
[1]: %load_ext autoreload
      %autoreload 2

      from libraries.embeddings_utils import *
      import ipynbname
      from scipy.stats import randint
      from sklearn.ensemble import VotingClassifier
      from libraries.classifier_utils import *
      from libraries.file_manager_utils import *
      from xgboost import XGBClassifier
      from sklearn.ensemble import RandomForestClassifier
      from scipy.stats import uniform

      project_dir = f"{os.getcwd()}.
      ↪split('SIDS_revelation_project')[0]}SIDS_revelation_project/"
      image_dataset_path = f"{project_dir}datasets/onback_onstomach_v3"
      model_path = f"{project_dir}/models/4.fd_weights/best.pt"
      model_path_fd = f"{project_dir}/models/4.fd_weights/best.pt"
      model_path_pe = f"{project_dir}/models/2.pe_weights/best.pt"
```

```
[2]: emb_builder = EmbeddingBuilder(model_path, image_dataset_path,
    ↪ "load", weights_path_pe=model_path_pe)
    embeddings = emb_builder.create_embedding(flags=True, positions=True,
    ↪ positions_normalized=True, geometric_info=True, k_positions_normalized=True,
    ↪ k_geometric_info=True)
```

Extracting dataset info from .coco.json

file:-----

Dataset contains 4158 valid samples, and labels are {'baby_on_back': 1,
'baby_on_stomach': 2}

Loading features from

.csv-----

Features loaded succesfully, in particular there are 4158 files in the dataset

Embedding builder initialized

successfully-----

Face detection model: 4 (YOLOv8)

Dataset: /Users/lorenzodimaio/Download/SIDS_revelation_project/datasets/onback_o
nstomach_v3

Dataset dimension: 4158

Dataset labels: {'baby_safe': 0, 'baby_unsafe': 1}

Embedding

creation-----

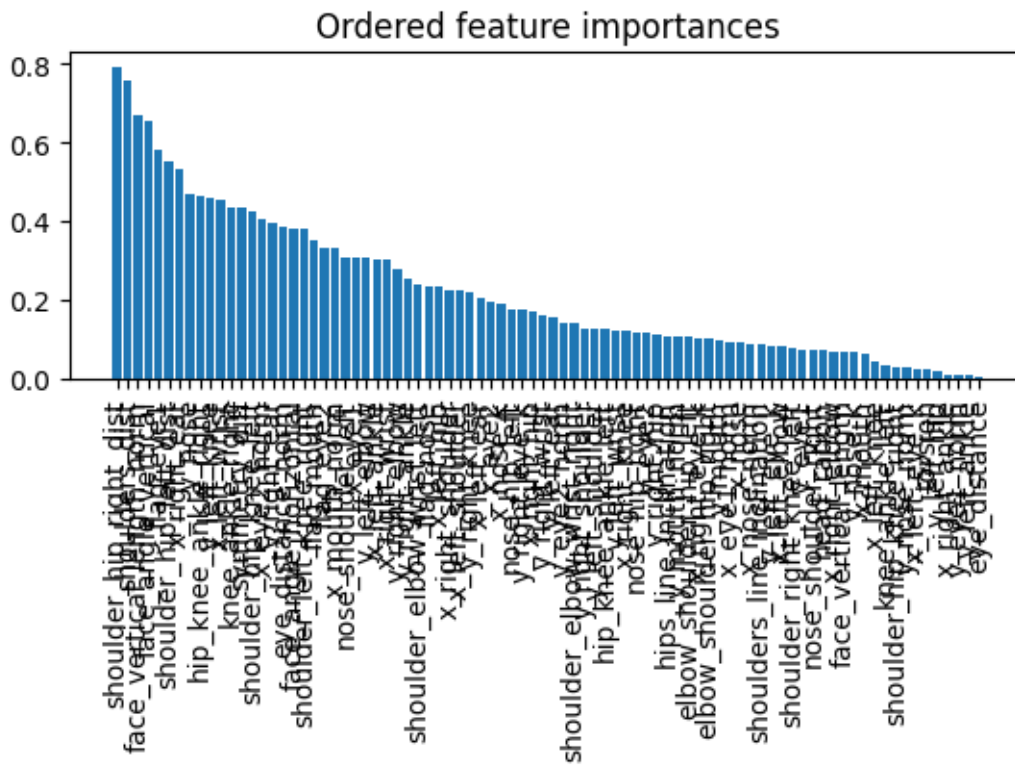
Features: ['flag_eye1', 'flag_eye2', 'flag_nose', 'flag_mouth', 'x_eye1',
'y_eye1', 'x_eye2', 'y_eye2', 'x_nose', 'y_nose', 'x_mouth', 'y_mouth',
'x_eye1_norm', 'y_eye1_norm', 'x_eye2_norm', 'y_eye2_norm', 'x_nose_norm',
'y_nose_norm', 'x_mouth_norm', 'y_mouth_norm', 'eye_distance',
'eye_distance_norm', 'face_vertical_length', 'face_vertical_length_norm',
'face_angle_vertical', 'face_angle_horizontal', 'symmetry_diff', 'head_ration',
'x_nose_k', 'y_nose_k', 'x_left_eye_k', 'y_left_eye_k', 'x_right_eye_k',
'y_right_eye_k', 'x_left_ear', 'y_left_ear', 'x_right_ear', 'y_right_ear',
'x_left_shoulder', 'y_left_shoulder', 'x_right_shoulder', 'y_right_shoulder',
'x_left_elbow', 'y_left_elbow', 'x_right_elbow', 'y_right_elbow',
'x_left_wrist', 'y_left_wrist', 'x_right_wrist', 'y_right_wrist', 'x_left_hip',
'y_left_hip', 'x_right_hip', 'y_right_hip', 'x_left_knee', 'y_left_knee',
'x_right_knee', 'y_right_knee', 'x_left_ankle', 'y_left_ankle', 'x_right_ankle',
'y_right_ankle', 'shoulders_dist', 'shoulder_hip_right_dist',
'shoulder_hip_left_dist', 'nose_shoulder_right', 'nose_shoulder_left',
'shoulder_left_knee_right', 'shoulder_right_knee_left', 'knee_ankle_right',

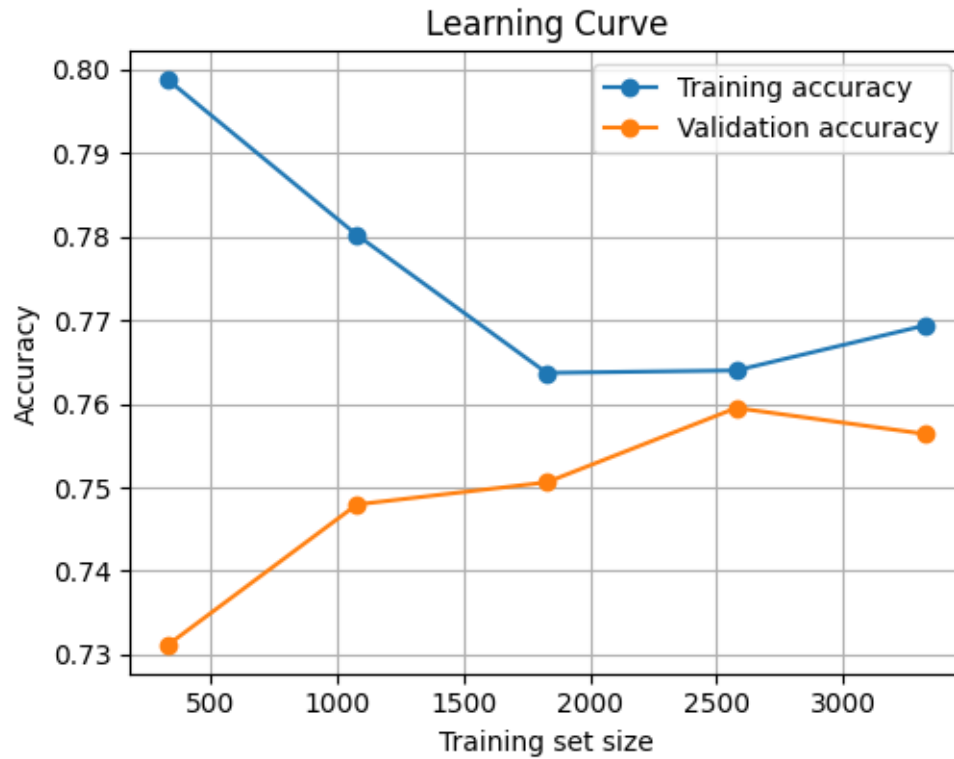
FINISHED: 4158 embedding created

2 2) Logistic Regression

```
lr_1, results_lr_1 = clf.logistic_regression(verbose=True)
```


-----FIRST
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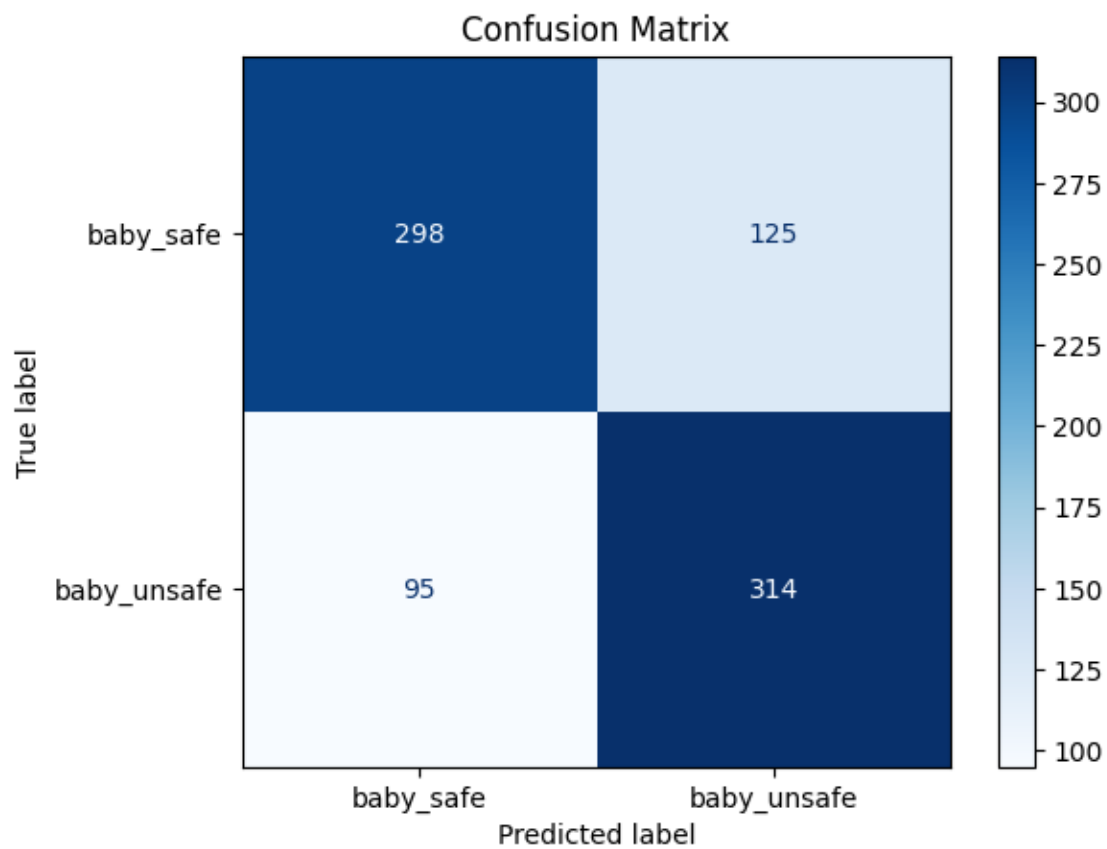
Dataset labels:-----

```
{'baby_safe': 0, 'baby_unsafe': 1}
```

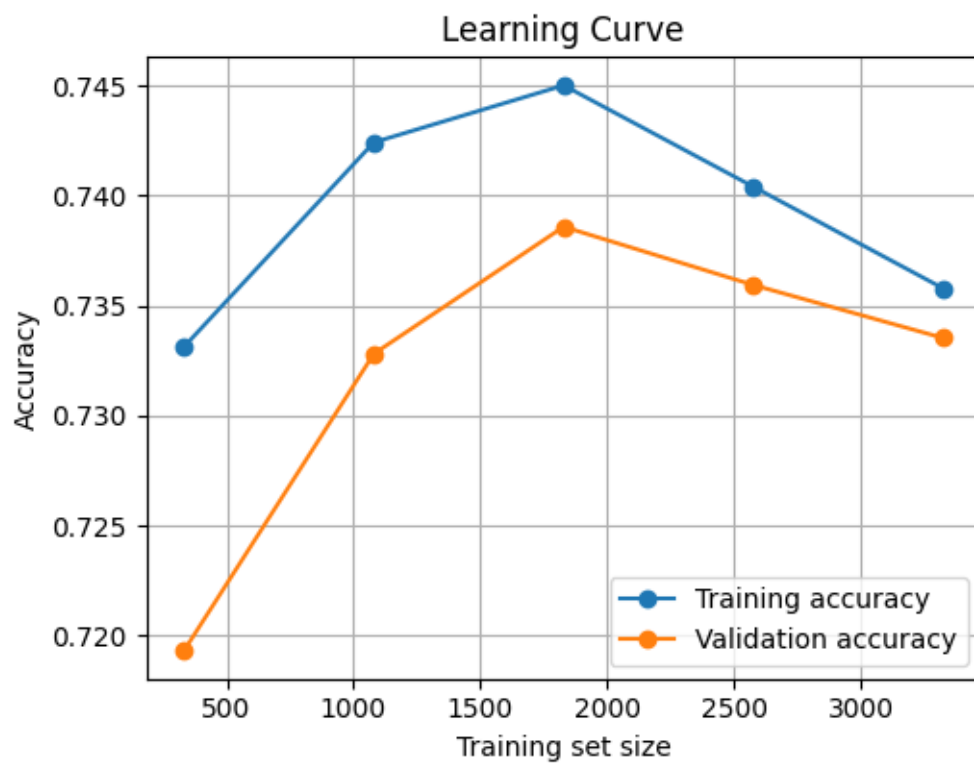
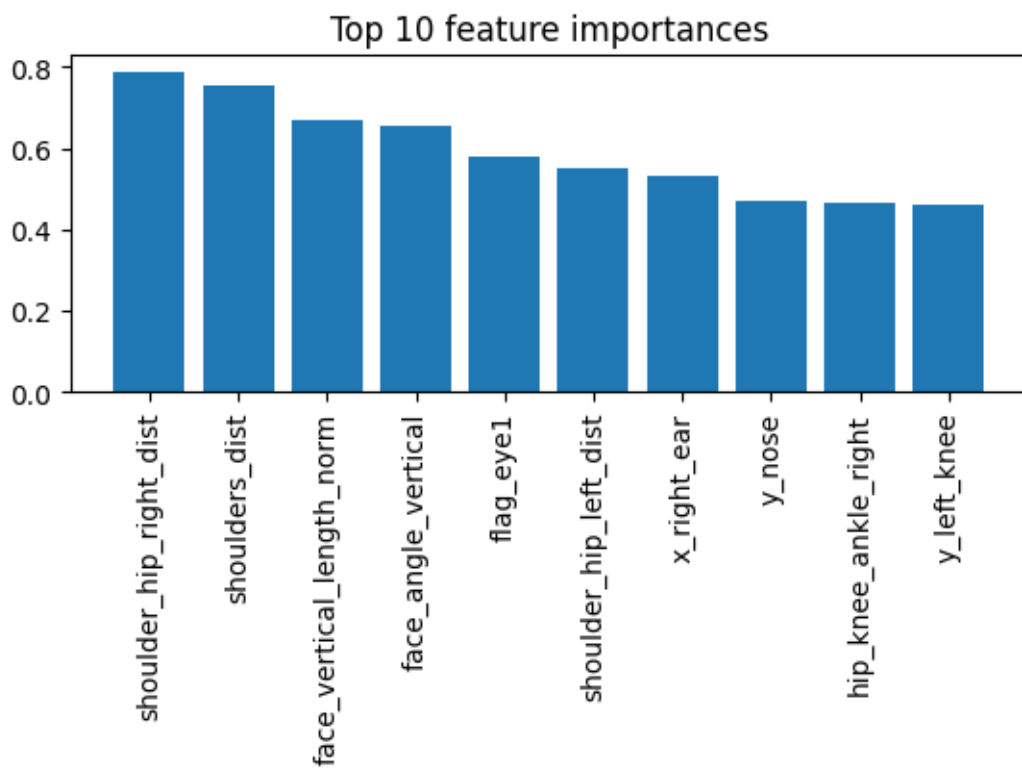
Report-----

	precision	recall	f1-score	support
baby_safe	0.76	0.70	0.73	423
baby_unsafe	0.72	0.77	0.74	409
accuracy			0.74	832
macro avg	0.74	0.74	0.74	832
weighted avg	0.74	0.74	0.74	832

Confusion matrix-----



-----TOP 10 FEATURES
ANALYSIS-----

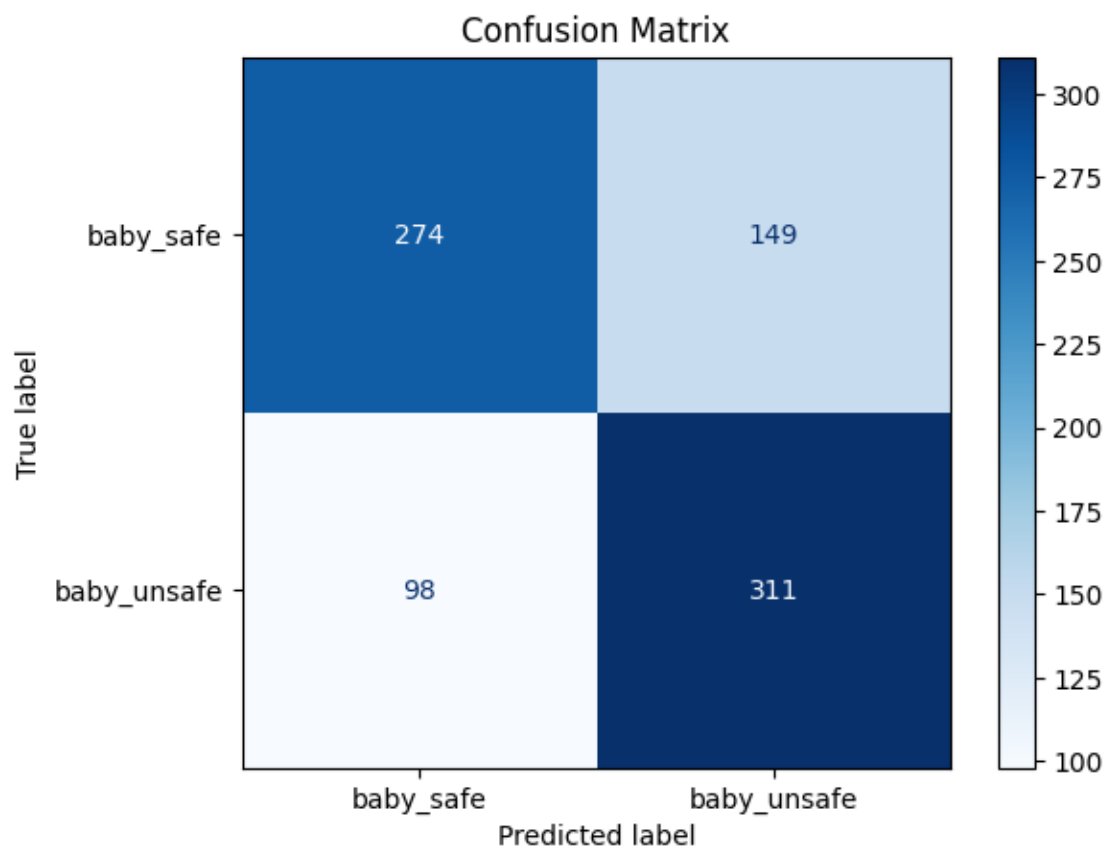


Dataset labels:-----
{'baby_safe': 0, 'baby_unsafe': 1}

Report-----

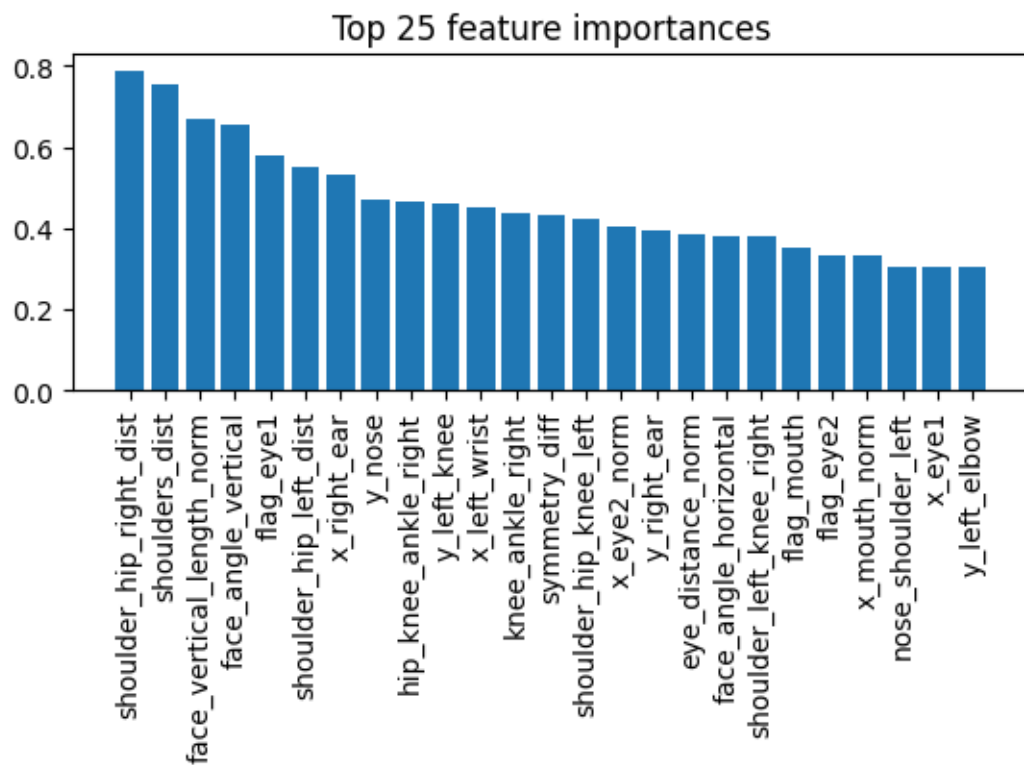
	precision	recall	f1-score	support
baby_safe	0.74	0.65	0.69	423
baby_unsafe	0.68	0.76	0.72	409
accuracy			0.70	832
macro avg	0.71	0.70	0.70	832
weighted avg	0.71	0.70	0.70	832

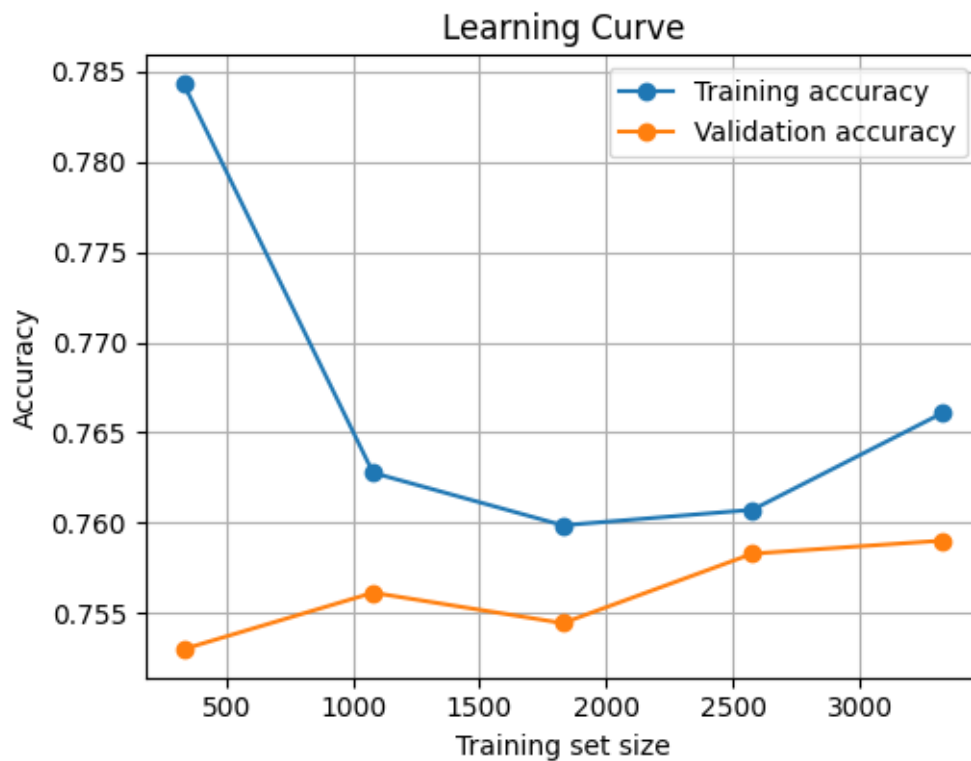
Confusion matrix-----



-----TOP 25 FEATURES

ANALYSIS-----



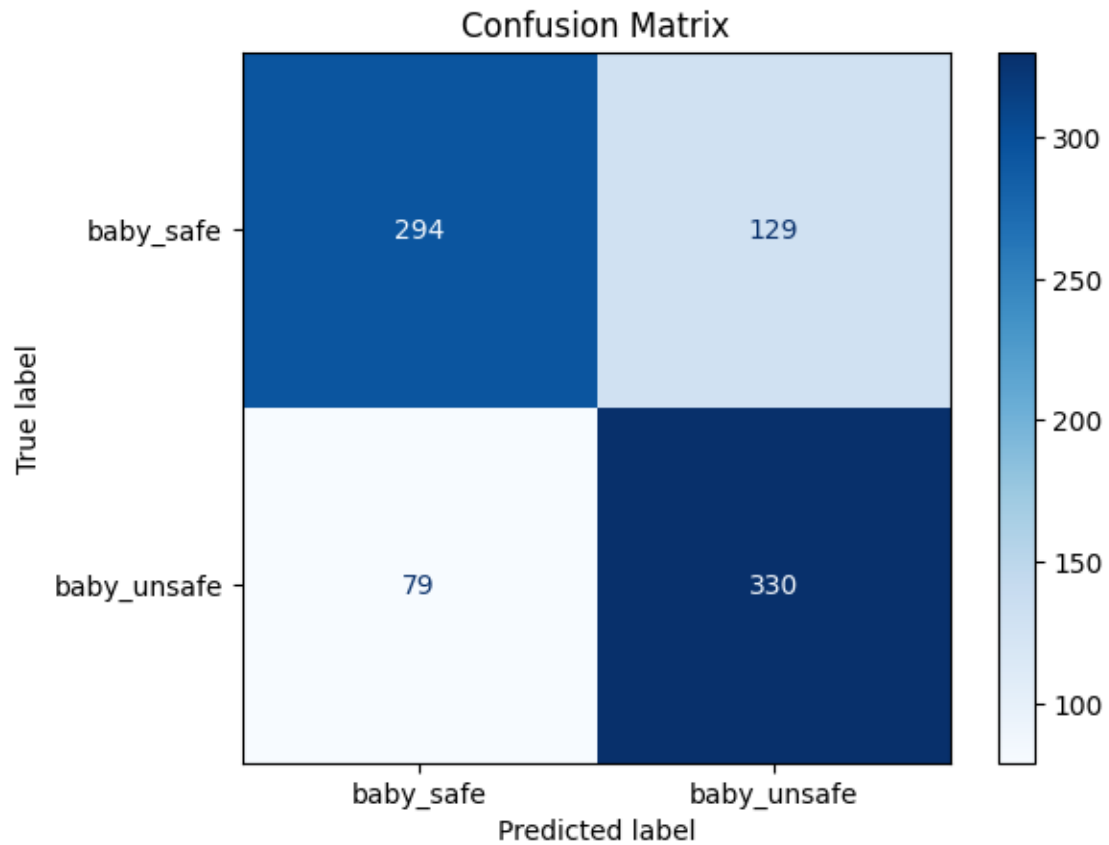


Dataset labels:-----
 {'baby_safe': 0, 'baby_unsafe': 1}

Report-----

	precision	recall	f1-score	support
baby_safe	0.79	0.70	0.74	423
baby_unsafe	0.72	0.81	0.76	409
accuracy			0.75	832
macro avg	0.75	0.75	0.75	832
weighted avg	0.75	0.75	0.75	832

Confusion matrix-----



```
[6]: from scipy.stats import loguniform
from sklearn.linear_model import LogisticRegression

from scipy.stats import loguniform

param_grid = [
    {
        'solver': ['liblinear'],
        'penalty': ['l1', 'l2'],
        'C': loguniform(0.001, 1000)
    },
    {
        'solver': ['saga'],
        'penalty': ['l1', 'l2'],
        'C': loguniform(0.001, 1000)
    },
    {
        'solver': ['saga'],
        'penalty': ['elasticnet'],
        'C': loguniform(0.001, 1000),
```

```

        'l1_ratio': [0.1, 0.5, 0.9]
    }
]
best_params = clf.optimize_model(lr_1, param_grid, verbose=False)
lr_2 = LogisticRegression(**best_params)
results_lr_2 = clf.evaluation_pipeline(lr_2, verbose=True)

```

Start random search...

Random Search Results:

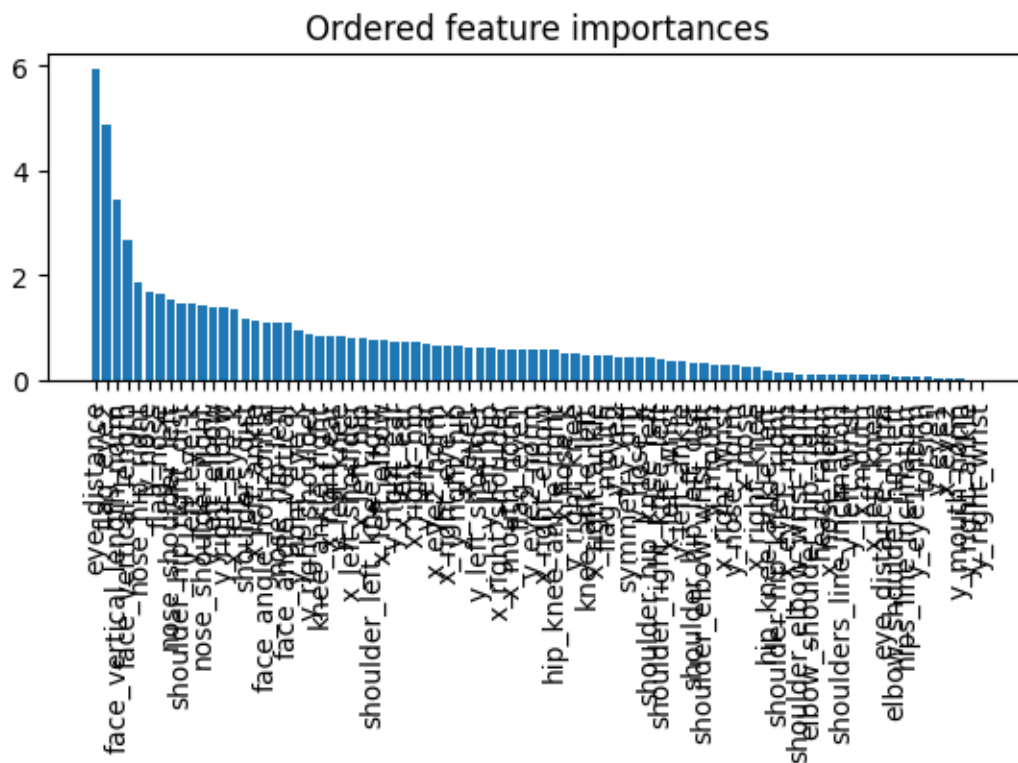
Best parameters found: {'C': np.float64(584.8333713948902), 'penalty': 'l1', 'solver': 'liblinear'}

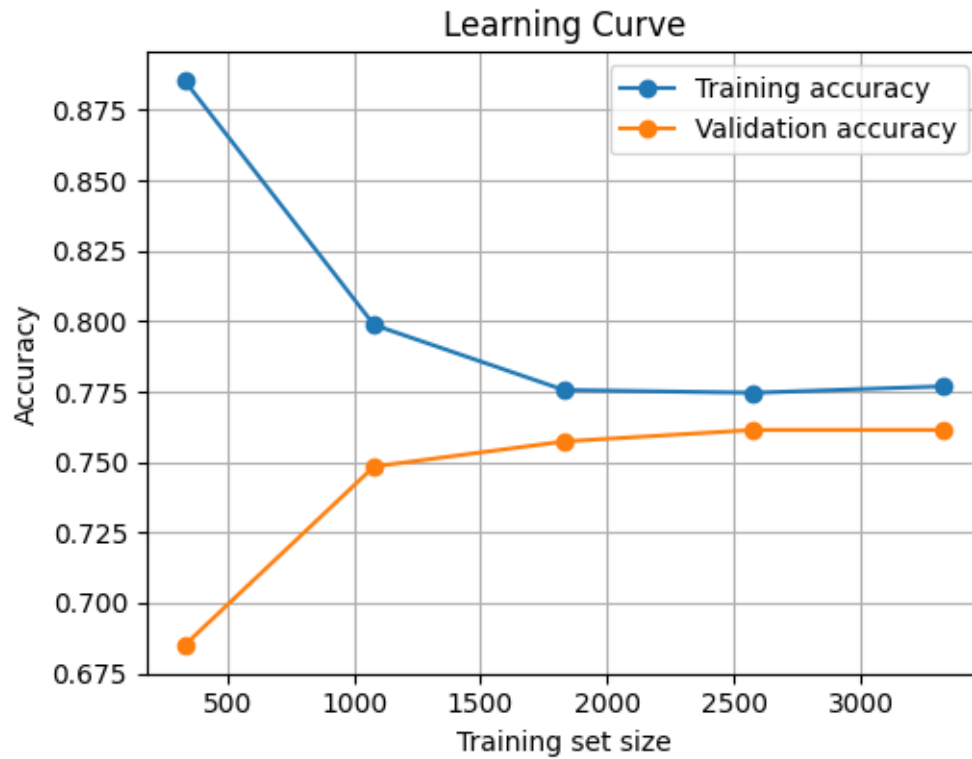
Best mean cross-validation accuracy: 0.7669814175077333

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/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-packages/sklearn/svm/_base.py:1250: ConvergenceWarning: Liblinear failed to converge, increase the number of iterations.

warnings.warn(





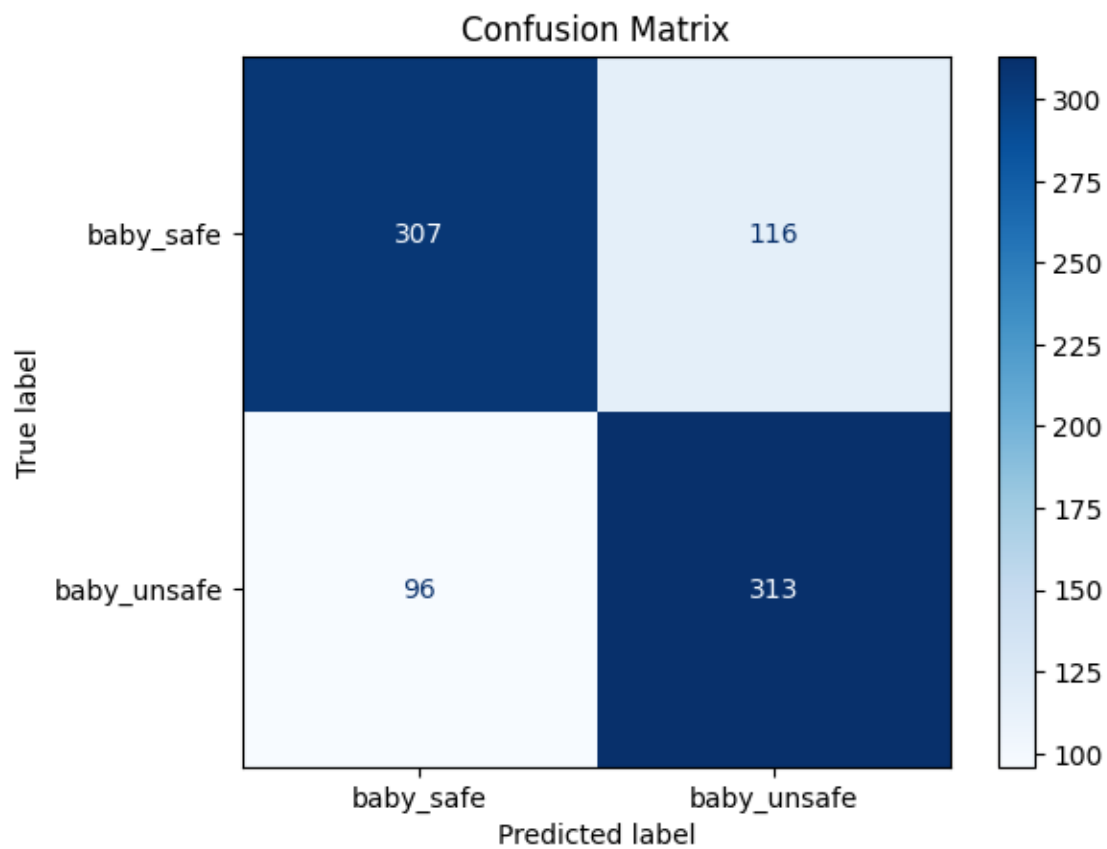
Dataset labels:-----

```
{'baby_safe': 0, 'baby_unsafe': 1}
```

Report-----

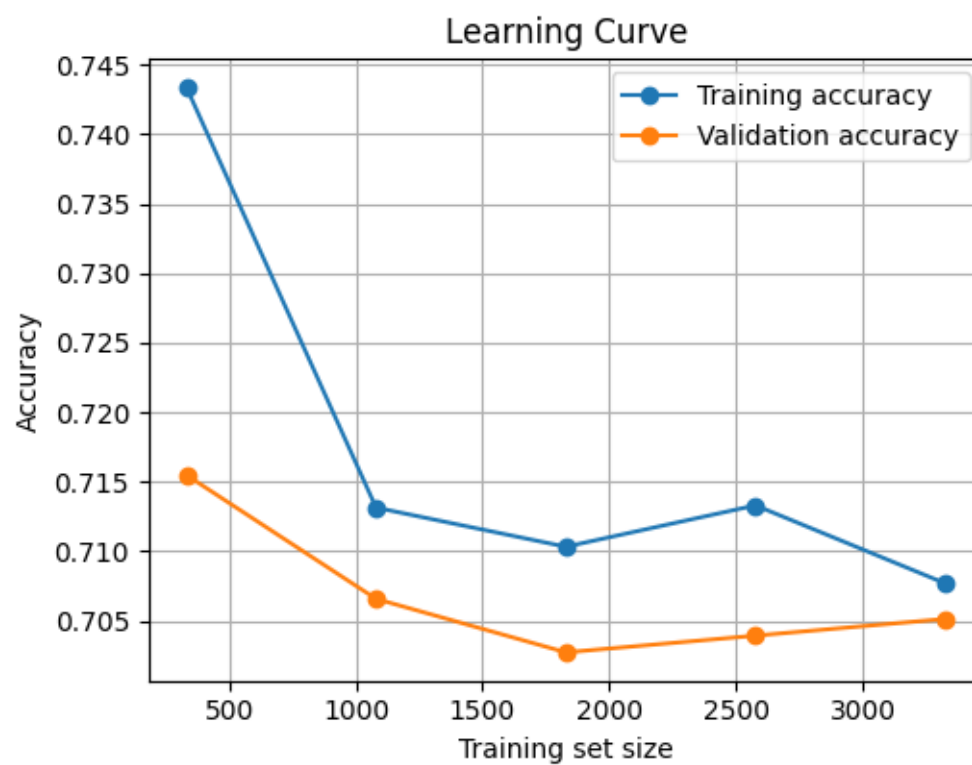
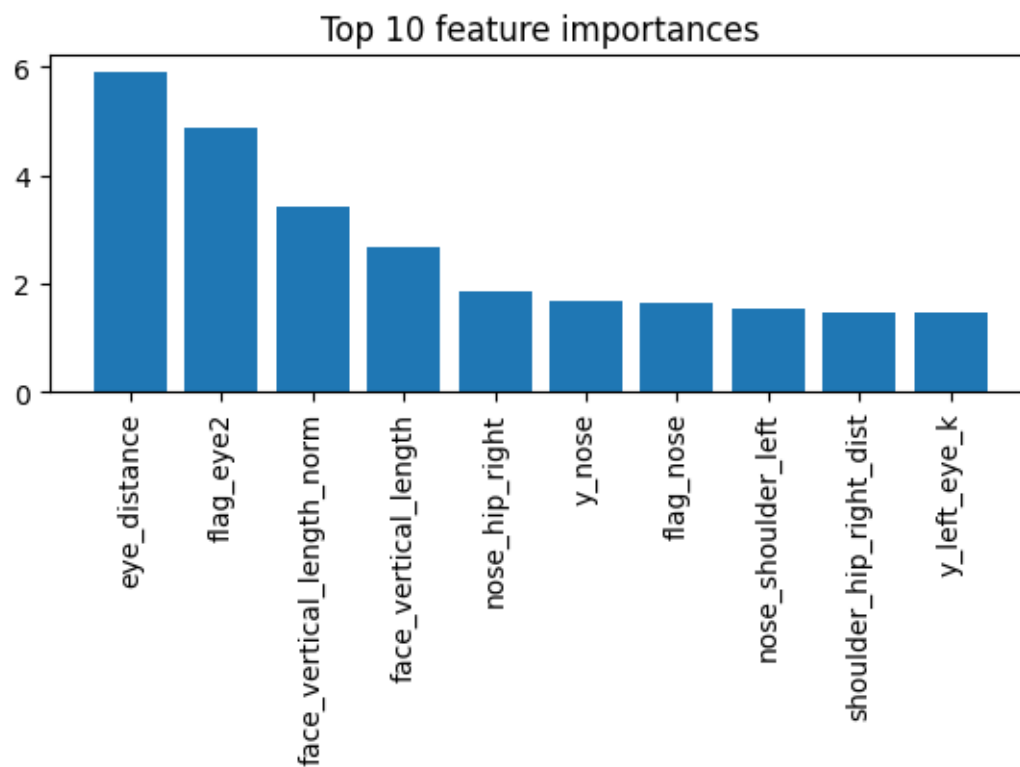
	precision	recall	f1-score	support
baby_safe	0.76	0.73	0.74	423
baby_unsafe	0.73	0.77	0.75	409
accuracy			0.75	832
macro avg	0.75	0.75	0.75	832
weighted avg	0.75	0.75	0.75	832

Confusion matrix-----



-----TOP 10 FEATURES

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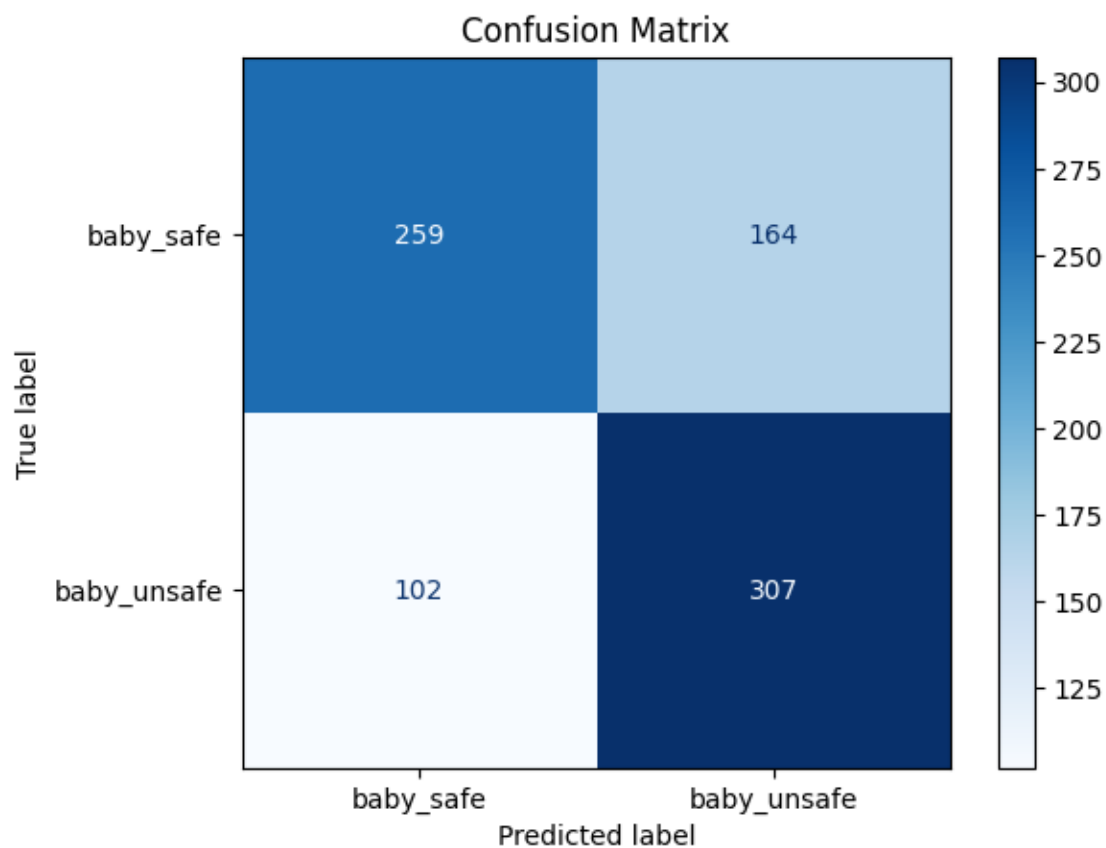


Dataset labels:-----
{'baby_safe': 0, 'baby_unsafe': 1}

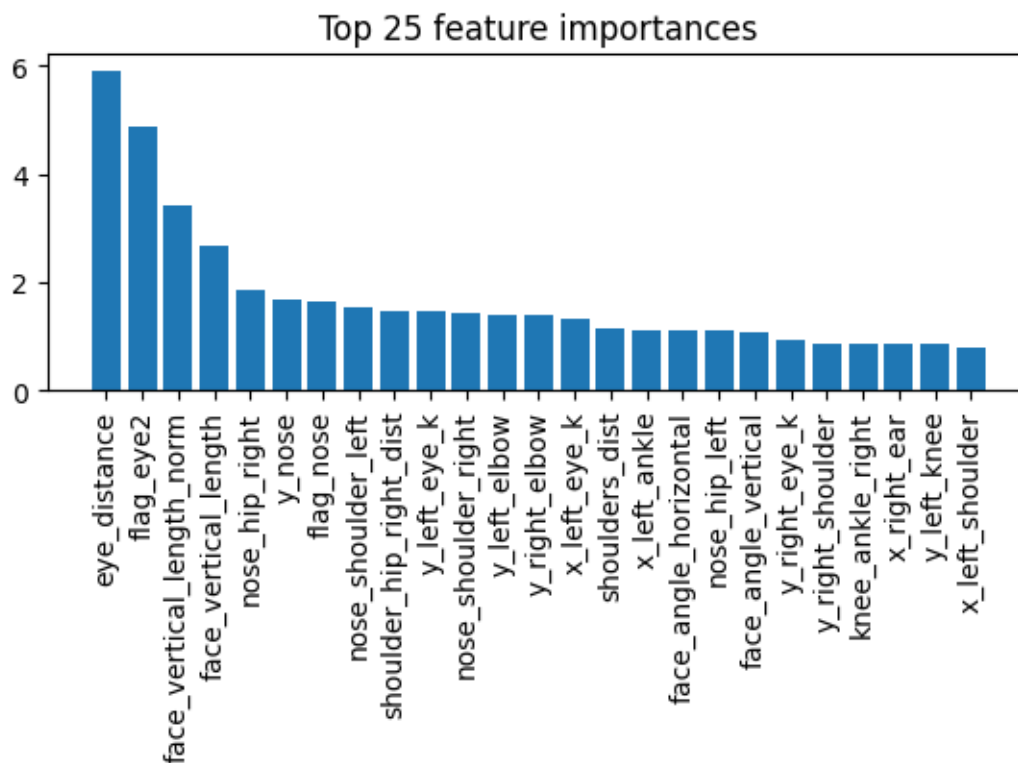
Report-----

	precision	recall	f1-score	support
baby_safe	0.72	0.61	0.66	423
baby_unsafe	0.65	0.75	0.70	409
accuracy			0.68	832
macro avg	0.68	0.68	0.68	832
weighted avg	0.69	0.68	0.68	832

Confusion matrix-----



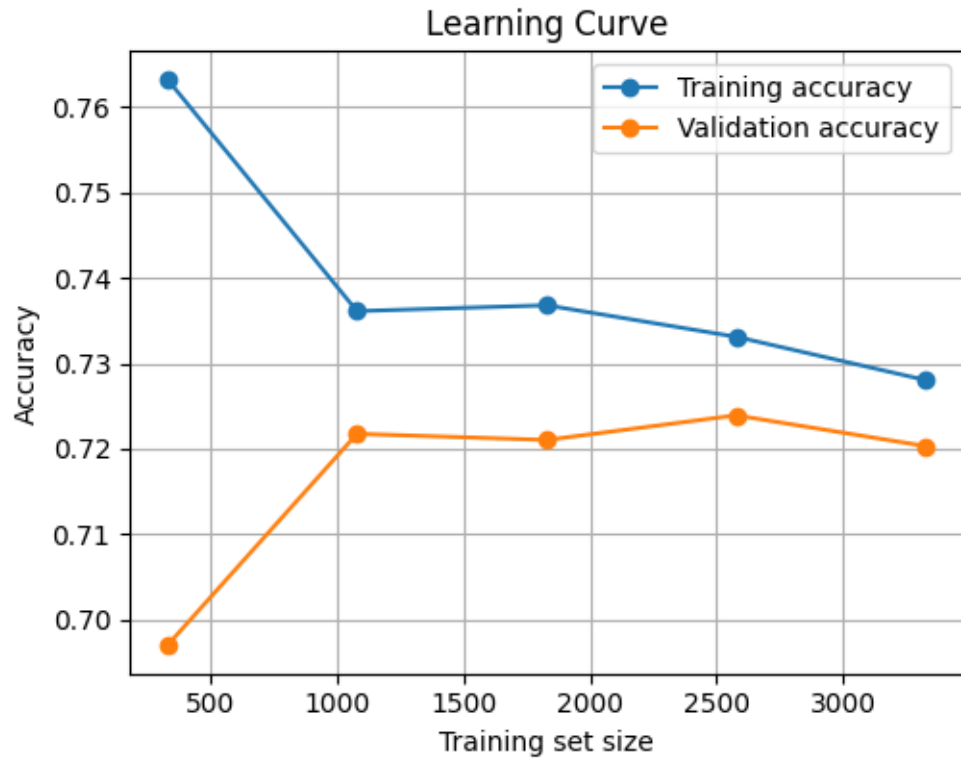
-----TOP 25 FEATURES
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```

/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/svm/_base.py:1250: ConvergenceWarning: Liblinear failed to
converge, increase the number of iterations.
  warnings.warn(
/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/svm/_base.py:1250: ConvergenceWarning: Liblinear failed to
converge, increase the number of iterations.
  warnings.warn(
/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/svm/_base.py:1250: ConvergenceWarning: Liblinear failed to
converge, increase the number of iterations.
  warnings.warn(

```

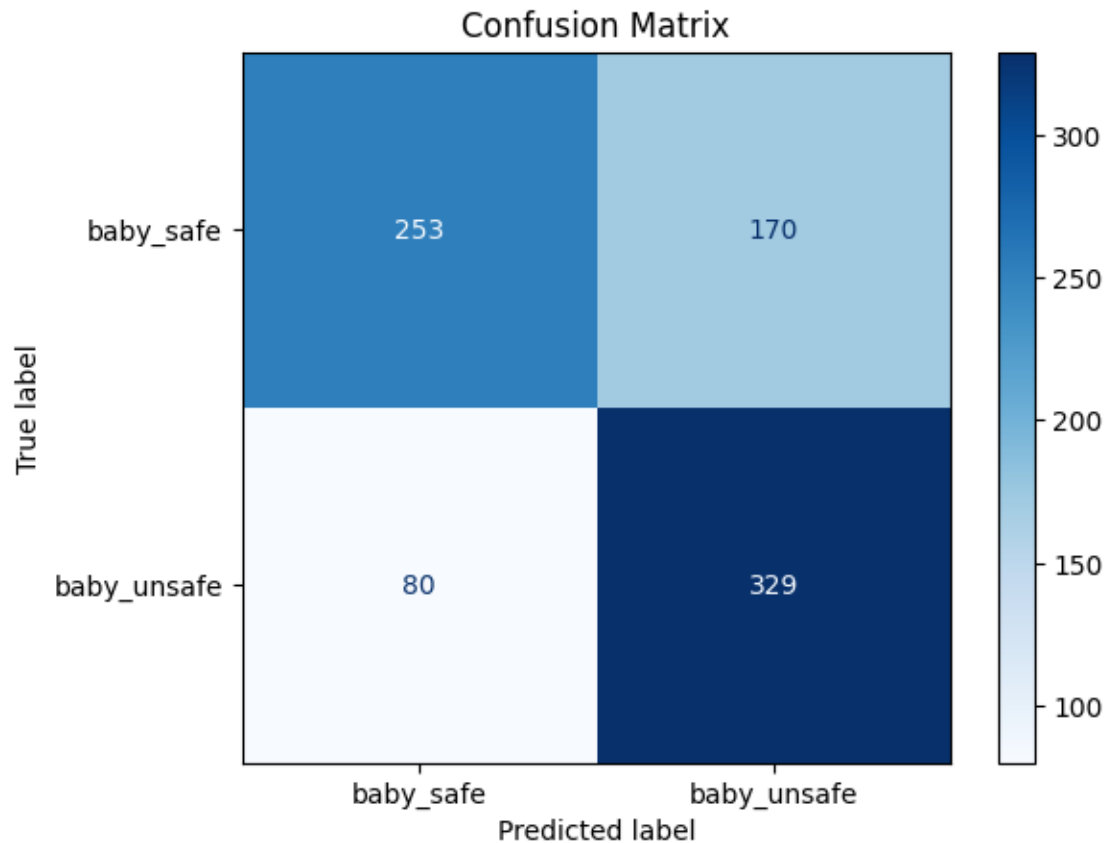
Dataset labels:-----

`{'baby_safe': 0, 'baby_unsafe': 1}`

Report-----

	precision	recall	f1-score	support
baby_safe	0.76	0.60	0.67	423
baby_unsafe	0.66	0.80	0.72	409
accuracy			0.70	832
macro avg	0.71	0.70	0.70	832
weighted avg	0.71	0.70	0.70	832

Confusion matrix-----



```
[8]: # Graph 1:
data_to_plot_1 = [
    (results_lr_1['all_features']['model'], "LR1 - All Features",
    ↪ results_lr_1['all_features']['X'], results_lr_1['all_features']['y']),
    (results_lr_2['all_features']['model'], "LR2 - All Features",
    ↪ results_lr_2['all_features']['X'], results_lr_2['all_features']['y'])
]

clf.plot_learning_curve_comparison(
    data_sets=data_to_plot_1,
    title="Comparison of Learning Curves: LR1 vs LR2"
)

# Graph 2:
data_to_plot_2 = [
    (results_lr_1['top_10_features']['model'], "LR1 - Top 10 Features",
    ↪ results_lr_1['top_10_features']['X'], results_lr_1['top_10_features']['y']),
    (results_lr_2['top_10_features']['model'], "LR2 - Top 10 Features",
    ↪ results_lr_2['top_10_features']['X'], results_lr_2['top_10_features']['y'])
]
```

```

]

clf.plot_learning_curve_comparison(
    data_sets=data_to_plot_2,
    title="Comparison of Learning Curves: LR1 vs LR2 (Top 10 features)"
)

# Graph 3:
data_to_plot_3 = [
    (results_lr_1['top_25_features']['model'], "LR1 - Top 25 Features",
    ↪results_lr_1['top_25_features']['X'], results_lr_1['top_25_features']['y']),
    (results_lr_2['top_25_features']['model'], "LR2 - Top 25 Features",
    ↪results_lr_2['top_25_features']['X'], results_lr_2['top_25_features']['y'])
]

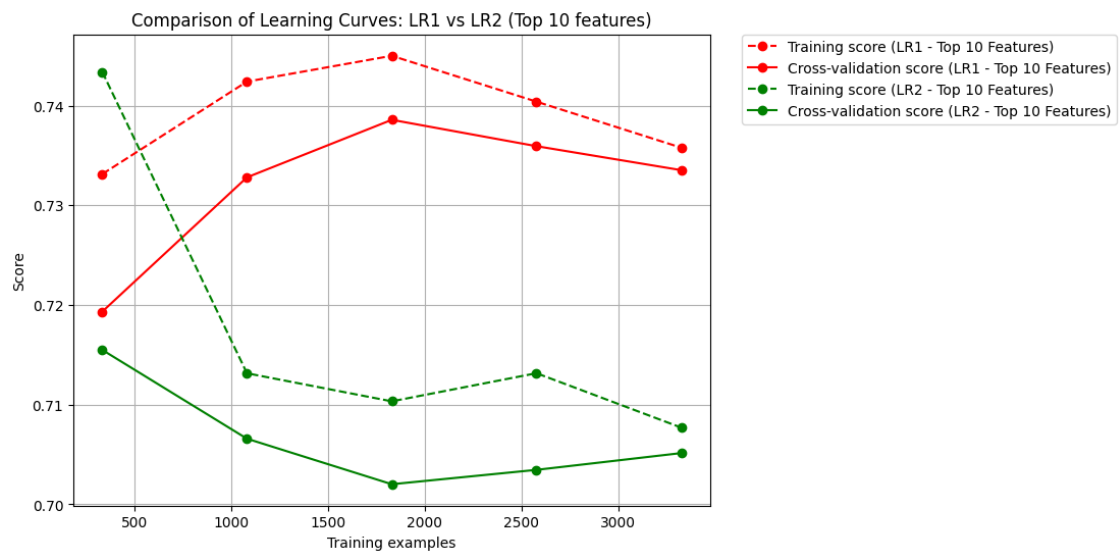
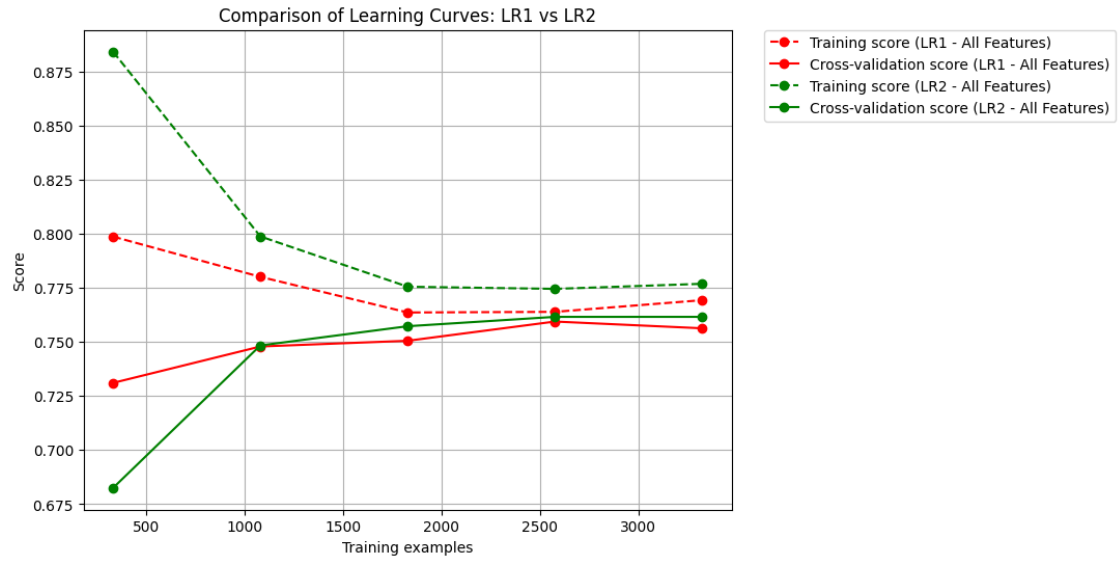
clf.plot_learning_curve_comparison(
    data_sets=data_to_plot_3,
    title="Comparison of Learning Curves: LR1 vs LR2 (Top 25 features)"
)

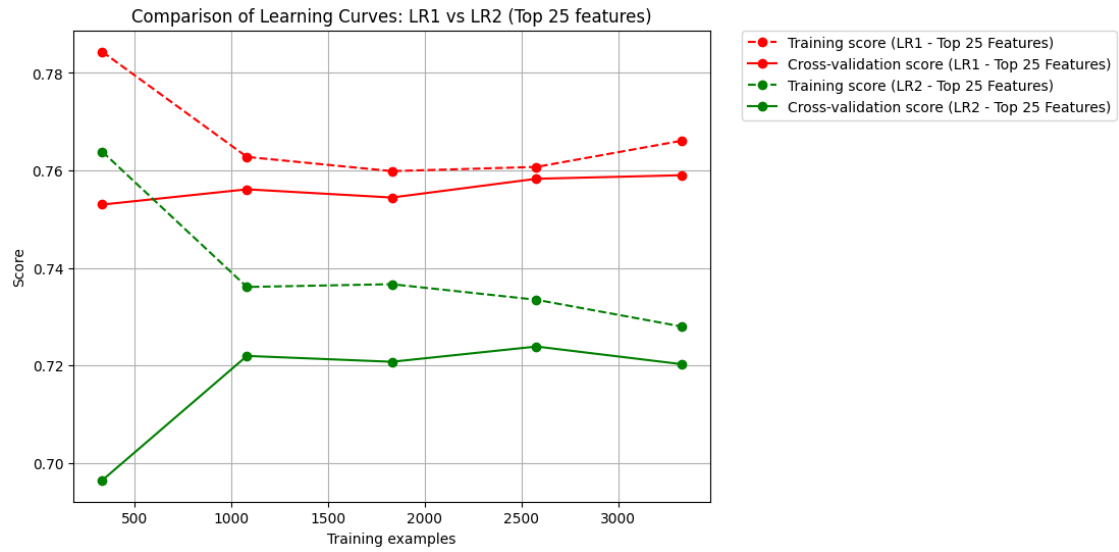
```

```

/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/svm/_base.py:1250: ConvergenceWarning: Liblinear failed to
converge, increase the number of iterations.
    warnings.warn(
/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/svm/_base.py:1250: ConvergenceWarning: Liblinear failed to
converge, increase the number of iterations.
    warnings.warn(
/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/svm/_base.py:1250: ConvergenceWarning: Liblinear failed to
converge, increase the number of iterations.
    warnings.warn(
/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/svm/_base.py:1250: ConvergenceWarning: Liblinear failed to
converge, increase the number of iterations.
    warnings.warn(

```



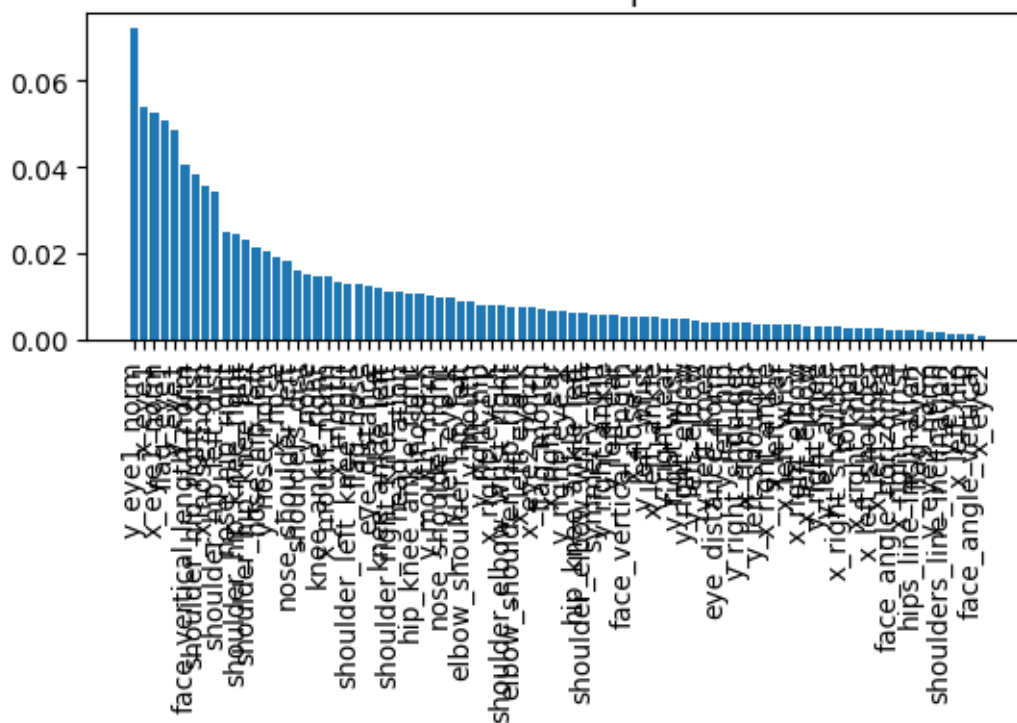


3 3) Random Forest

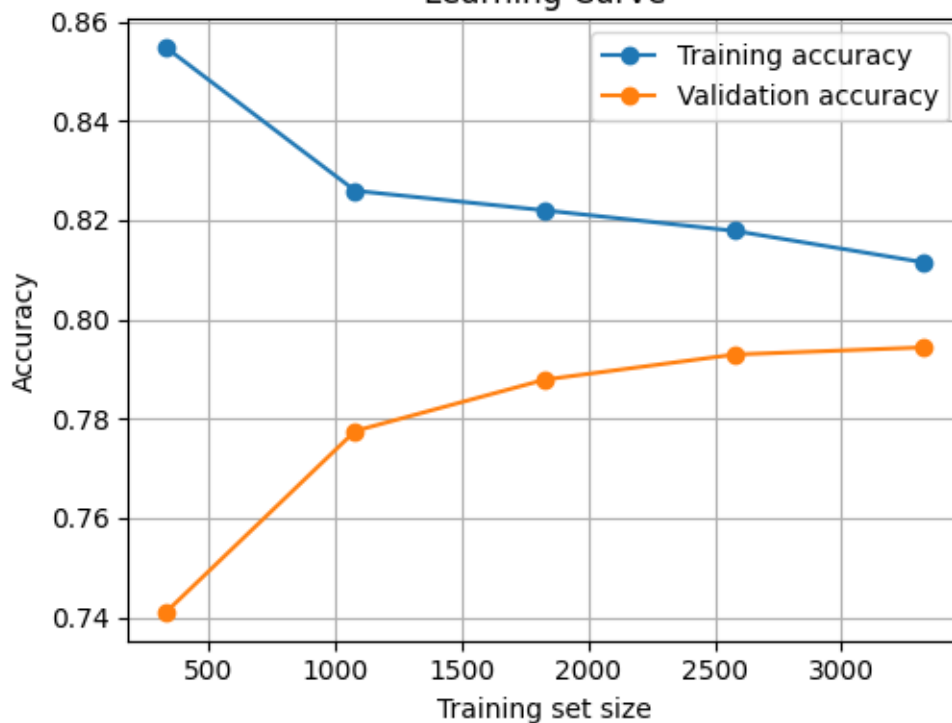
```
[9]: random_forest_1, results_rf1 = clf.random_forest(verbose=True)
```

```
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-----
-----FIRST
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-----
```

Ordered feature importances



Learning Curve

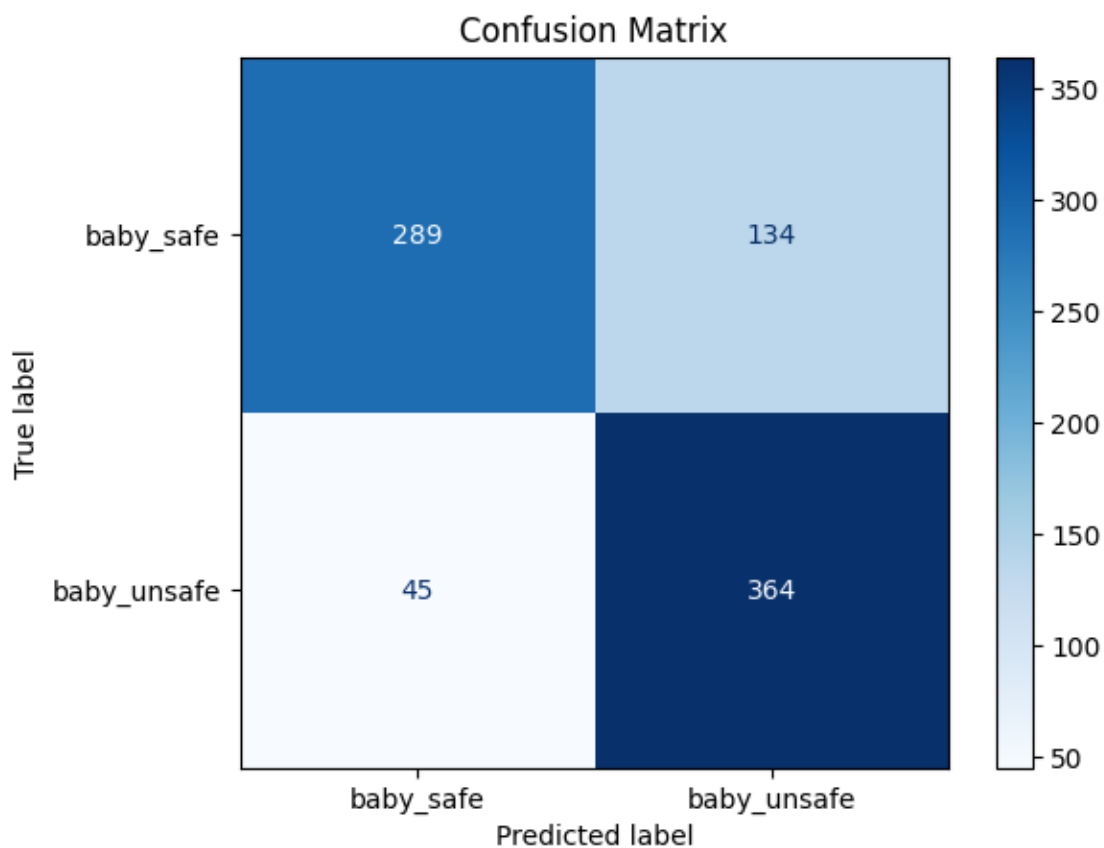


Dataset labels:-----
{'baby_safe': 0, 'baby_unsafe': 1}

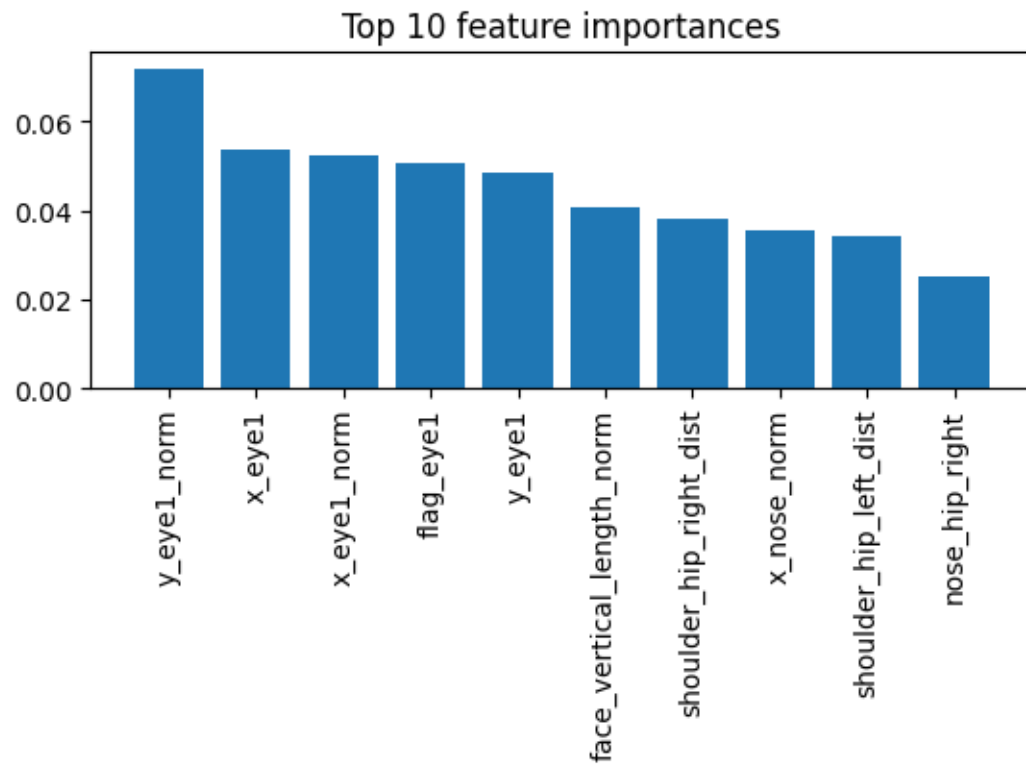
Report-----

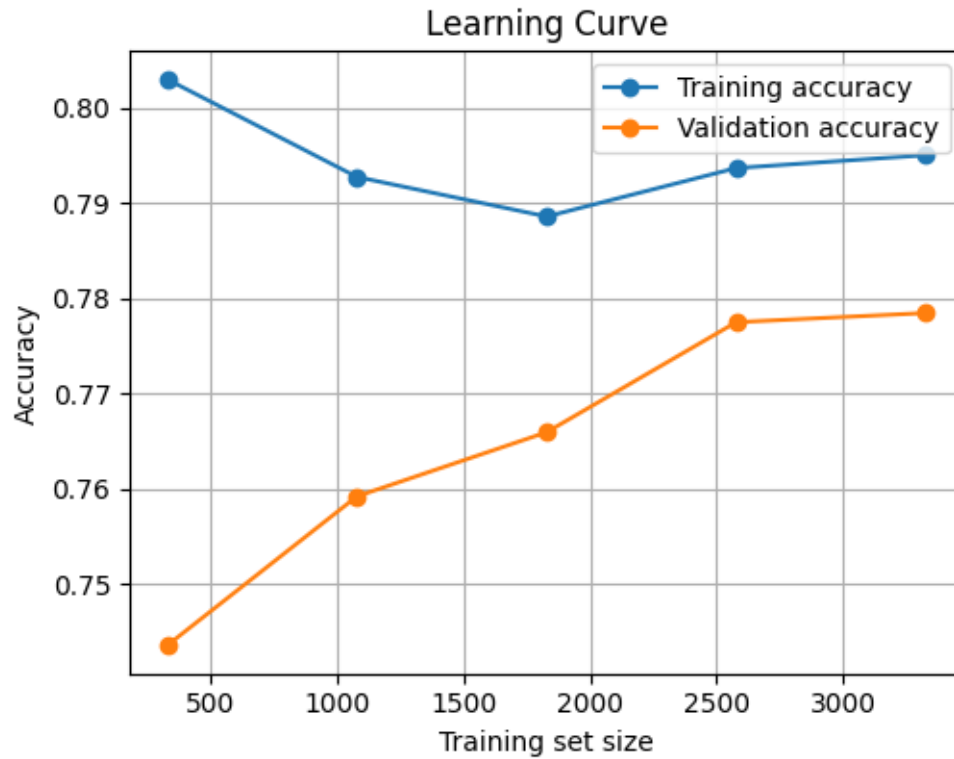
	precision	recall	f1-score	support
baby_safe	0.87	0.68	0.76	423
baby_unsafe	0.73	0.89	0.80	409
accuracy			0.78	832
macro avg	0.80	0.79	0.78	832
weighted avg	0.80	0.78	0.78	832

Confusion matrix-----



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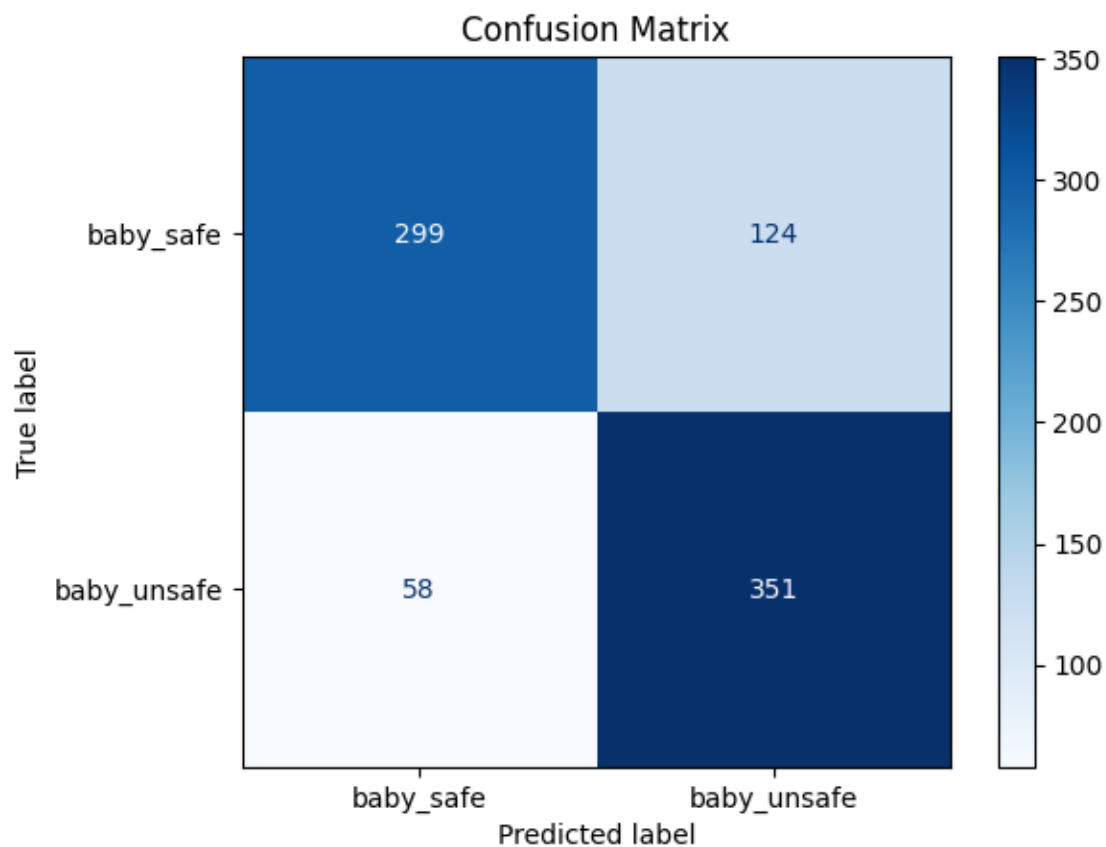
Dataset labels:-----

```
{'baby_safe': 0, 'baby_unsafe': 1}
```

Report-----

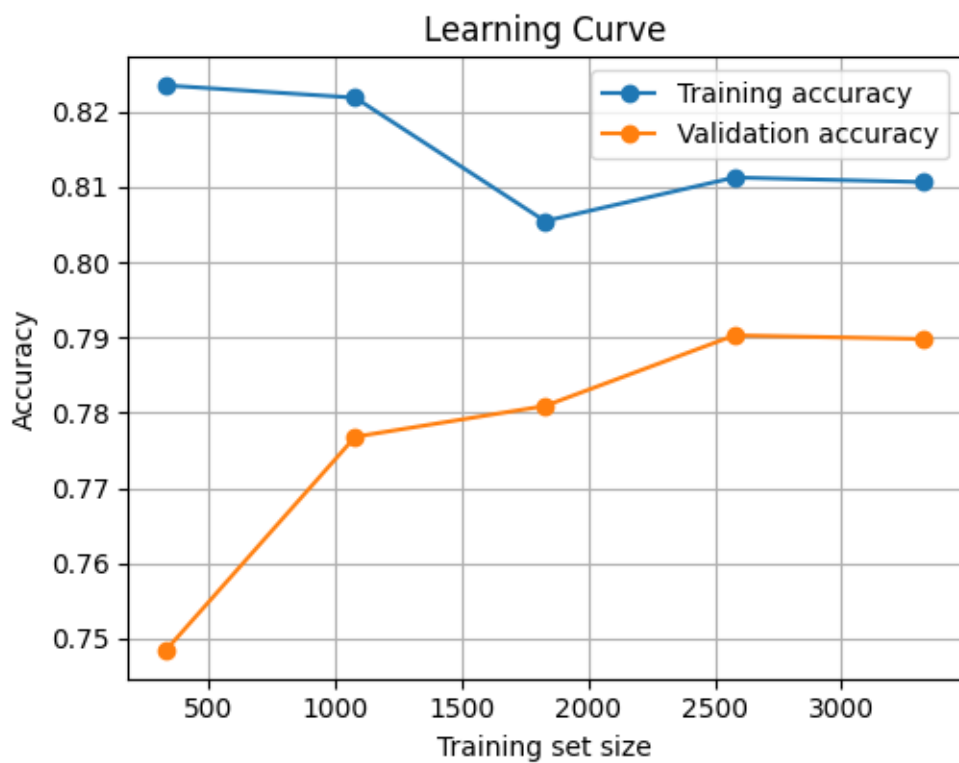
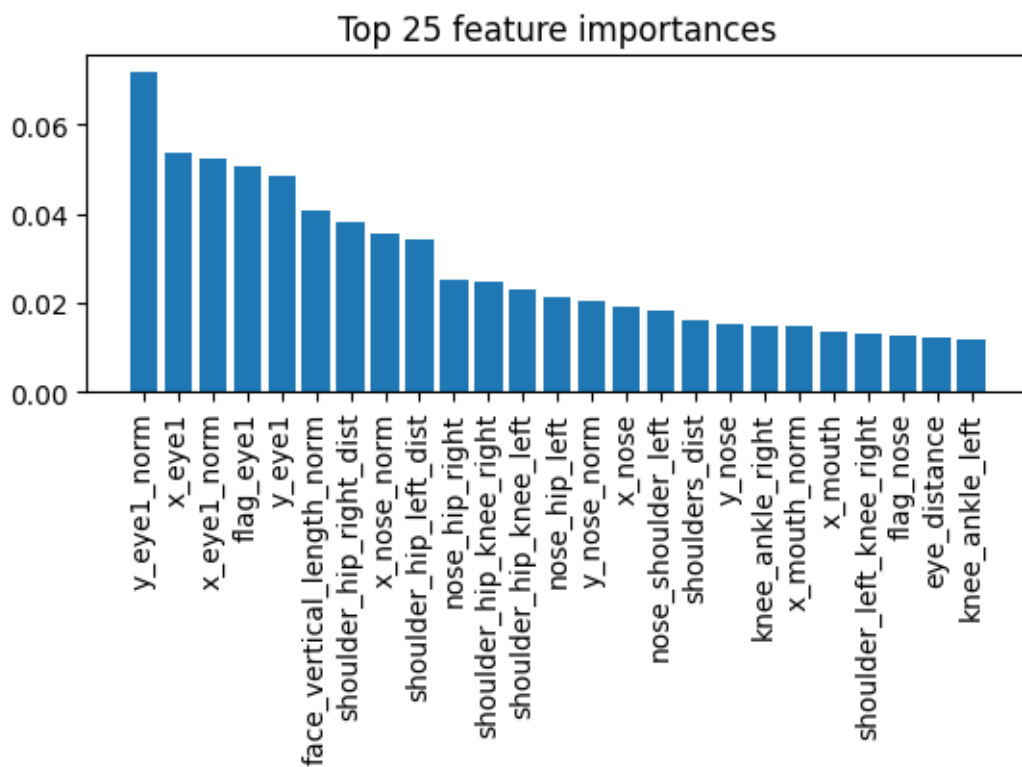
	precision	recall	f1-score	support
baby_safe	0.84	0.71	0.77	423
baby_unsafe	0.74	0.86	0.79	409
accuracy			0.78	832
macro avg	0.79	0.78	0.78	832
weighted avg	0.79	0.78	0.78	832

Confusion matrix-----



-----TOP 25 FEATURES

ANALYSIS-----

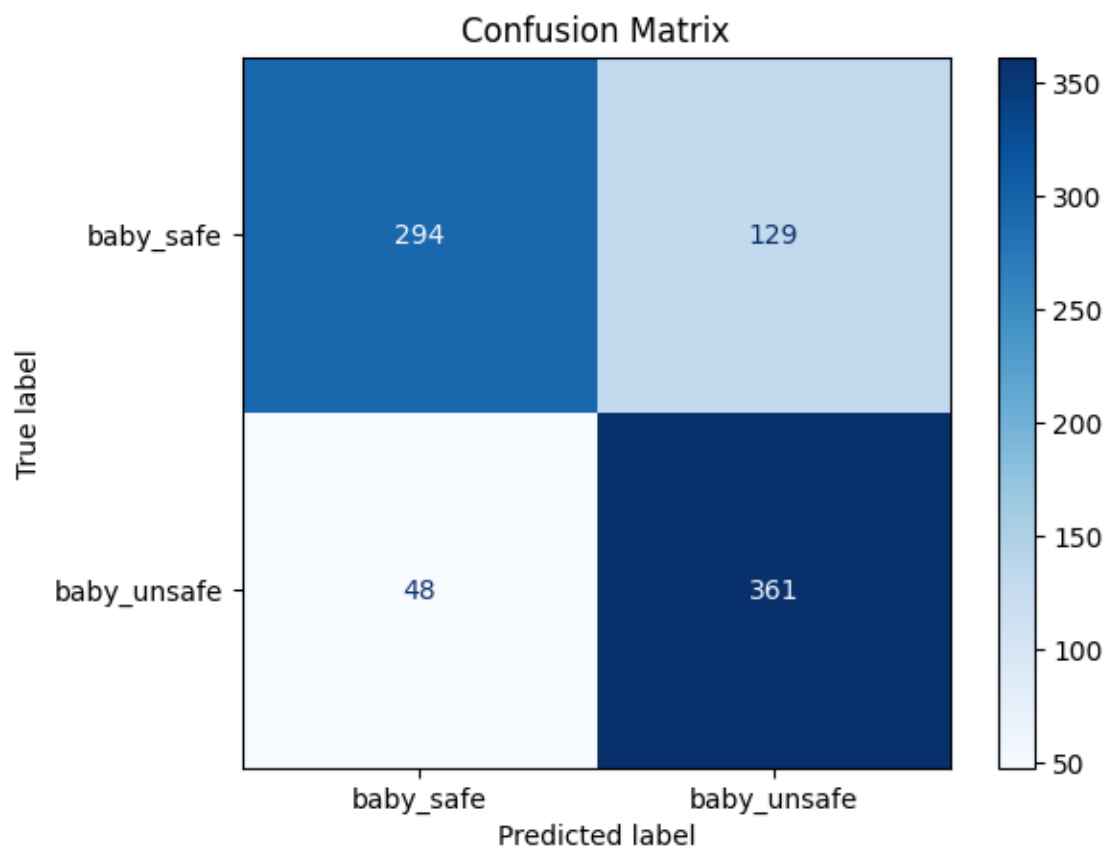


Dataset labels:-----
{'baby_safe': 0, 'baby_unsafe': 1}

Report-----

	precision	recall	f1-score	support
baby_safe	0.86	0.70	0.77	423
baby_unsafe	0.74	0.88	0.80	409
accuracy			0.79	832
macro avg	0.80	0.79	0.79	832
weighted avg	0.80	0.79	0.79	832

Confusion matrix-----



```
[10]: param_dist = [
    # Bootstrap = True (max_samples valido)
    {
        'n_estimators': randint(200, 1000),
        'max_depth': randint(5, 50),
        'min_samples_split': randint(2, 40),
        'min_samples_leaf': randint(1, 25),
        'max_features': ['sqrt', 'log2', 0.5, 0.7, 0.9, None],
        'criterion': ['gini', 'entropy'],
        'bootstrap': [True],
        'max_samples': uniform(0.5, 0.5) # fra 0.5 e 1.0
    },
    # Bootstrap = False (max_samples deve essere None)
    {
        'n_estimators': randint(200, 1000),
        'max_depth': randint(5, 50),
        'min_samples_split': randint(2, 40),
        'min_samples_leaf': randint(1, 25),
        'max_features': ['sqrt', 'log2', 0.5, 0.7, 0.9, None],
        'criterion': ['gini', 'entropy'],
        'bootstrap': [False],
        'max_samples': [None]
    }
]

best_params = clf.optimize_model(random_forest_1, param_dist, verbose=False)
random_forest_2 = RandomForestClassifier(**best_params)
results_rf2 = clf.evaluation_pipeline(random_forest_2, verbose=True)
```

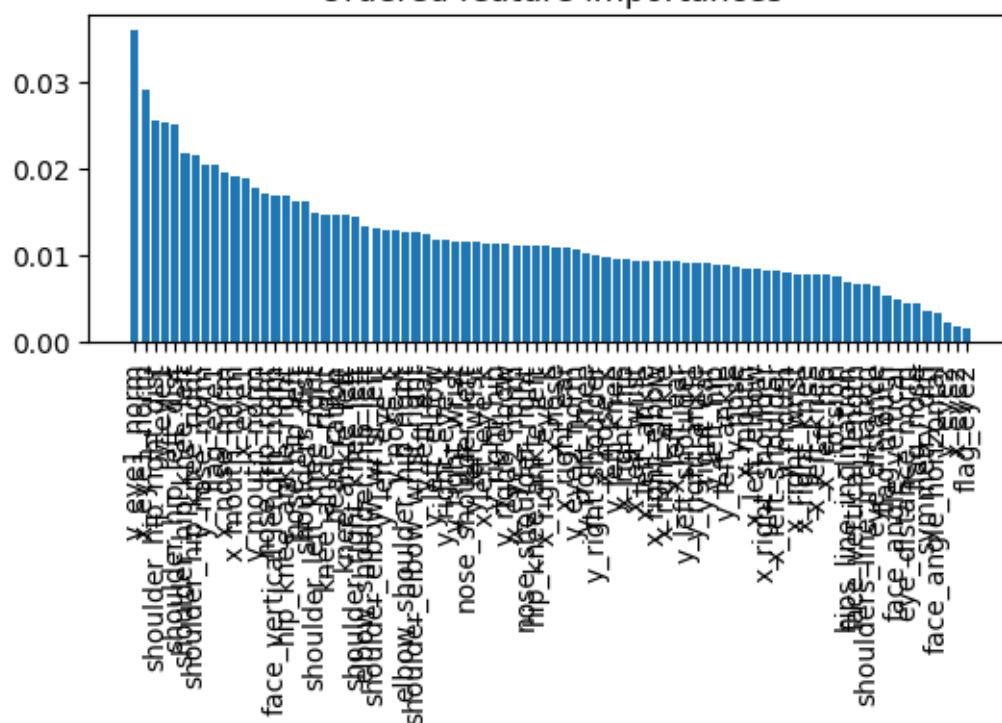
Start random search...

Random Search Results:

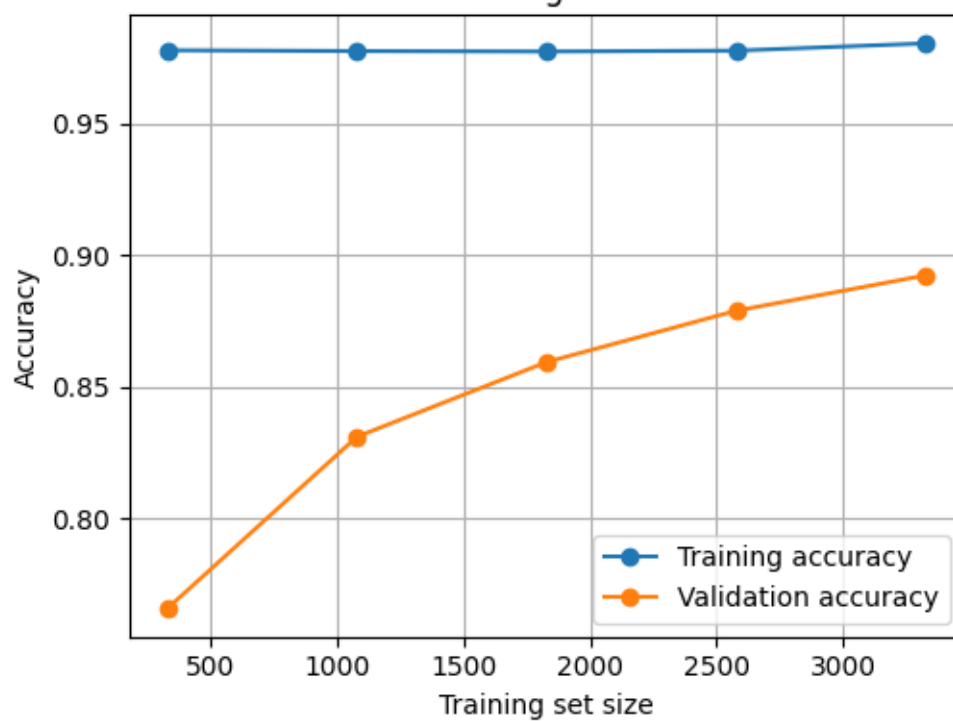
Best parameters found: {'bootstrap': False, 'criterion': 'entropy',
'max_depth': 23, 'max_features': 'log2', 'max_samples': None,
'min_samples_leaf': 1, 'min_samples_split': 15, 'n_estimators': 570}
Best mean cross-validation accuracy: 0.8869461943146154

```
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```

Ordered feature importances



Learning Curve

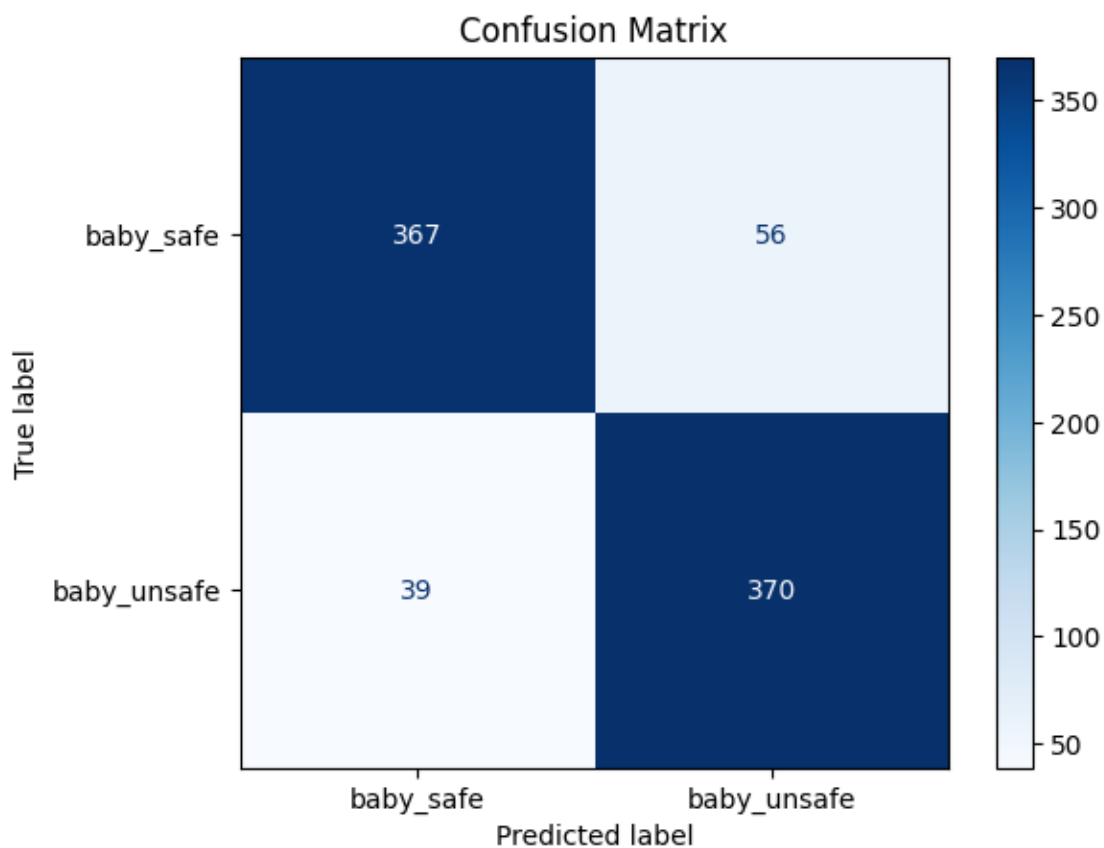


Dataset labels:-----
{'baby_safe': 0, 'baby_unsafe': 1}

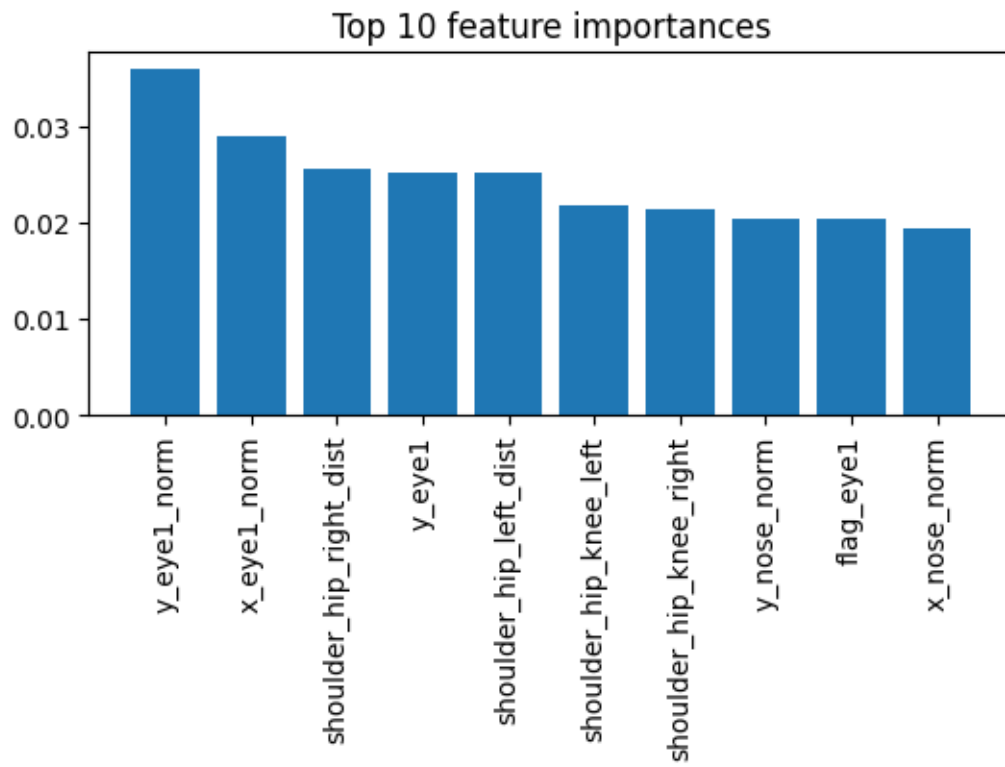
Report-----

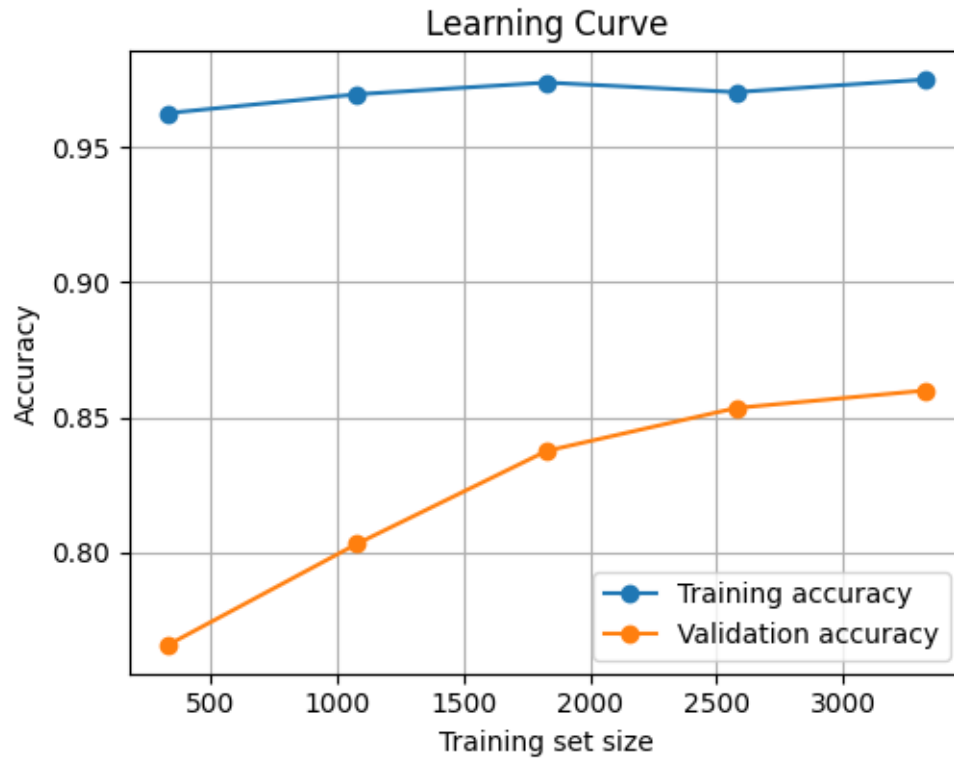
	precision	recall	f1-score	support
baby_safe	0.90	0.87	0.89	423
baby_unsafe	0.87	0.90	0.89	409
accuracy			0.89	832
macro avg	0.89	0.89	0.89	832
weighted avg	0.89	0.89	0.89	832

Confusion matrix-----



-----TOP 10 FEATURES
ANALYSIS-----





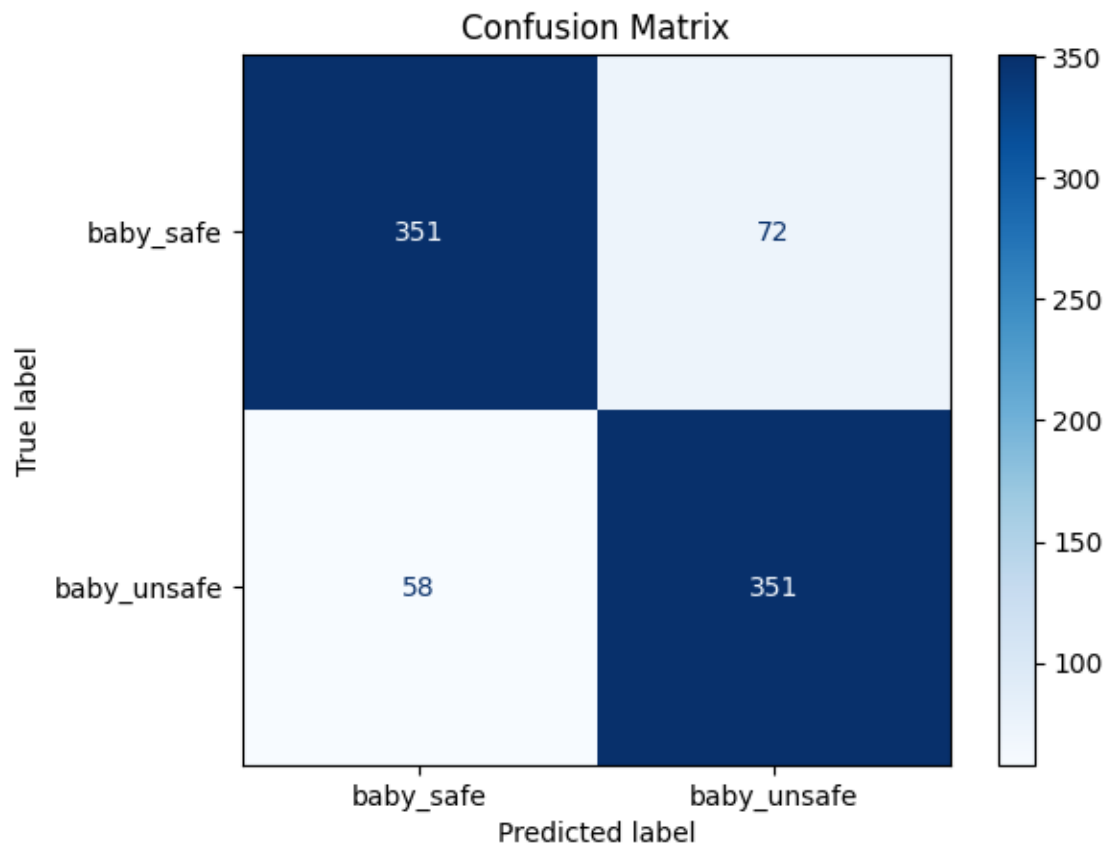
Dataset labels:-----

`{'baby_safe': 0, 'baby_unsafe': 1}`

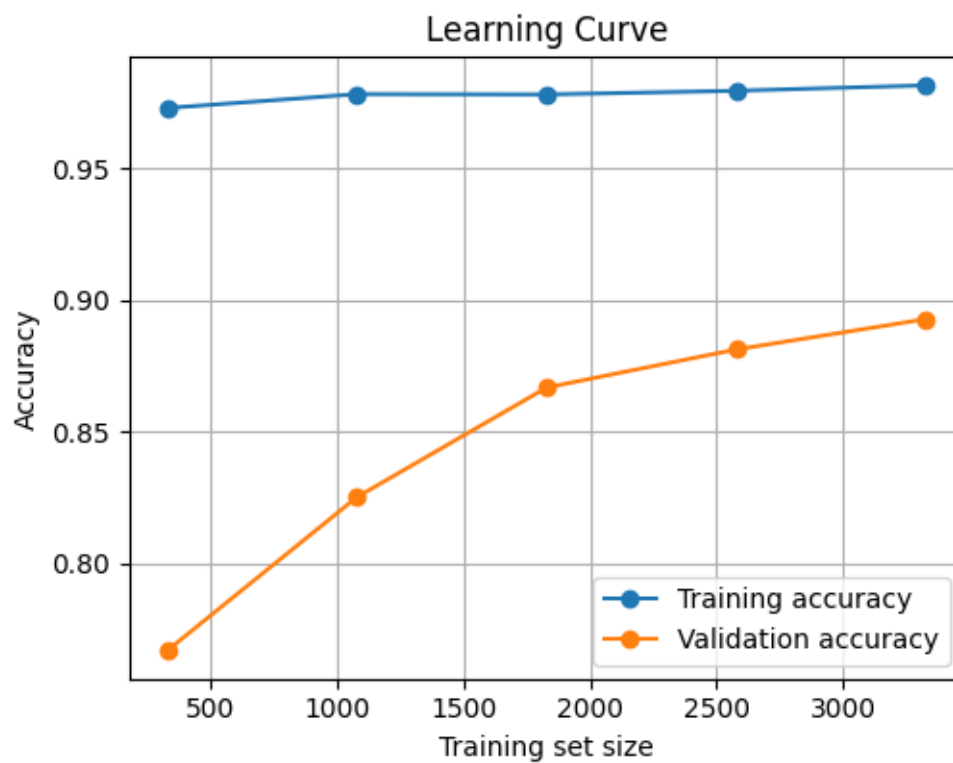
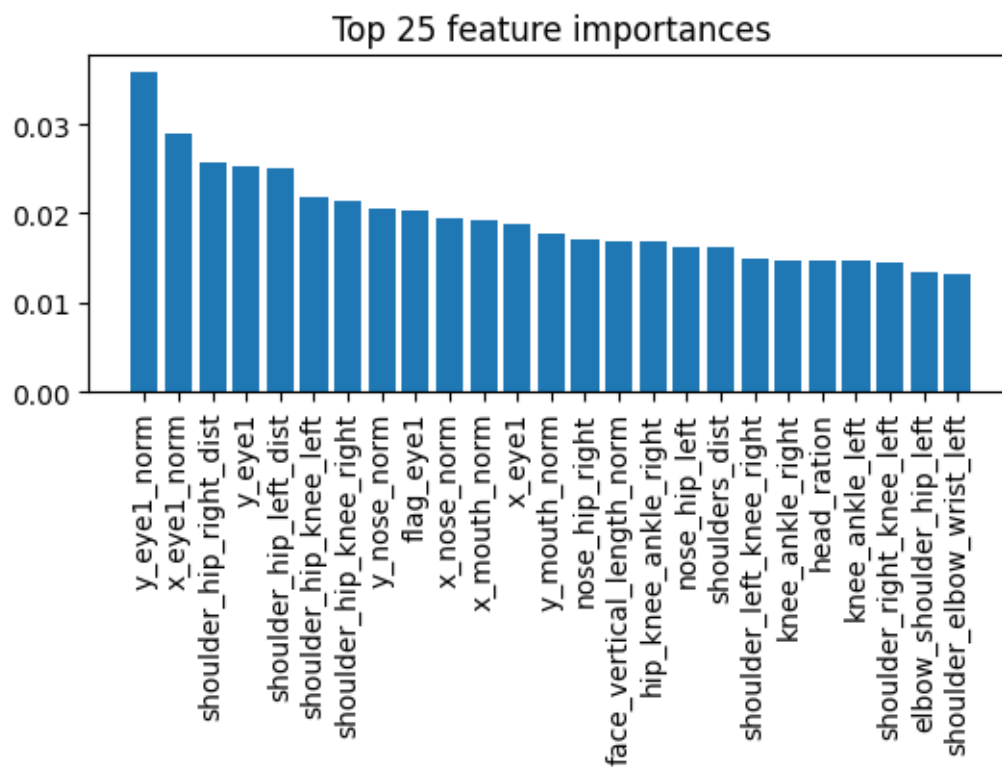
Report-----

	precision	recall	f1-score	support
baby_safe	0.86	0.83	0.84	423
baby_unsafe	0.83	0.86	0.84	409
accuracy			0.84	832
macro avg	0.84	0.84	0.84	832
weighted avg	0.84	0.84	0.84	832

Confusion matrix-----



-----TOP 25 FEATURES
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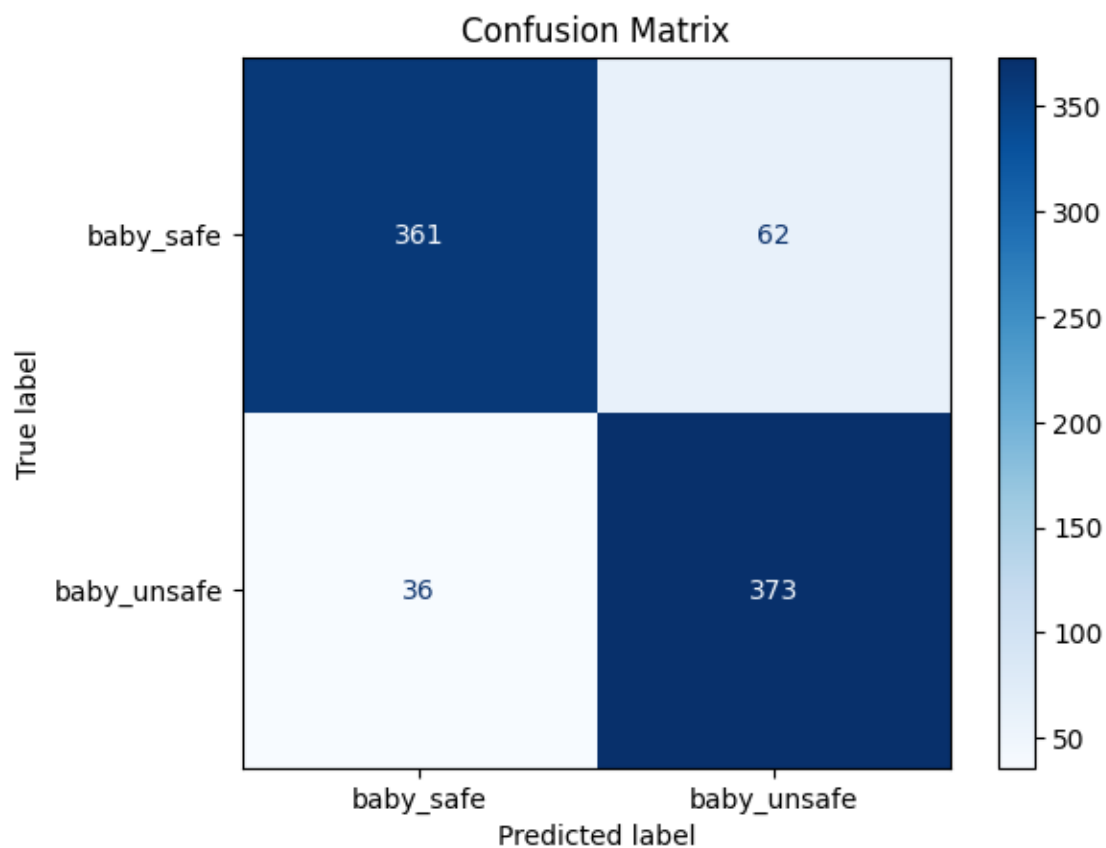


Dataset labels:-----
{'baby_safe': 0, 'baby_unsafe': 1}

Report-----

	precision	recall	f1-score	support
baby_safe	0.91	0.85	0.88	423
baby_unsafe	0.86	0.91	0.88	409
accuracy			0.88	832
macro avg	0.88	0.88	0.88	832
weighted avg	0.88	0.88	0.88	832

Confusion matrix-----



```

[11]: # Graph 1:
data_to_plot_1 = [
    (results_rf1['all_features']['model'], "RF1 - All Features",
    ↪results_rf1['all_features']['X'], results_rf1['all_features']['y']),
    (results_rf2['all_features']['model'], "RF2 - All Features",
    ↪results_rf2['all_features']['X'], results_rf2['all_features']['y'])
]

clf.plot_learning_curve_comparison(
    data_sets=data_to_plot_1,
    title="Comparison of Learning Curves: LR1 vs LR2: RF1 vs RF1"
)

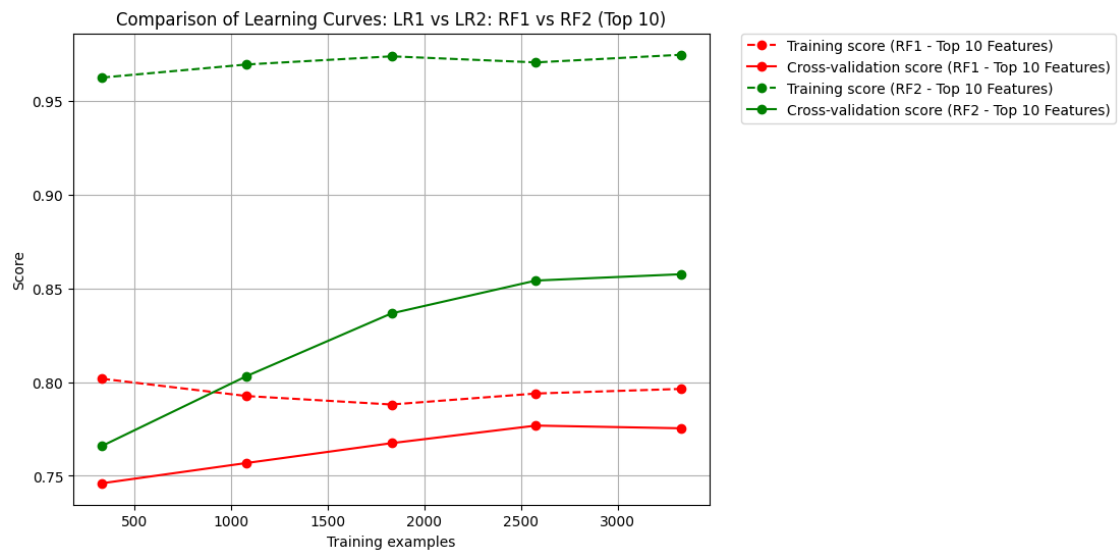
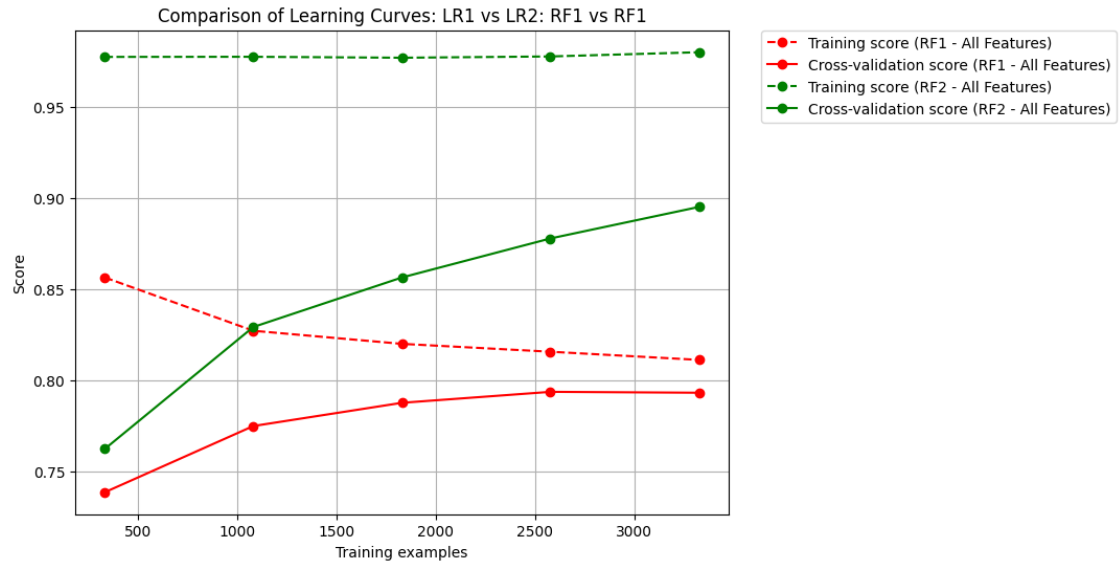
# Graph 2:
data_to_plot_2 = [
    (results_rf1['top_10_features']['model'], "RF1 - Top 10 Features",
    ↪results_rf1['top_10_features']['X'], results_rf1['top_10_features']['y']),
    (results_rf2['top_10_features']['model'], "RF2 - Top 10 Features",
    ↪results_rf2['top_10_features']['X'], results_rf2['top_10_features']['y'])
]

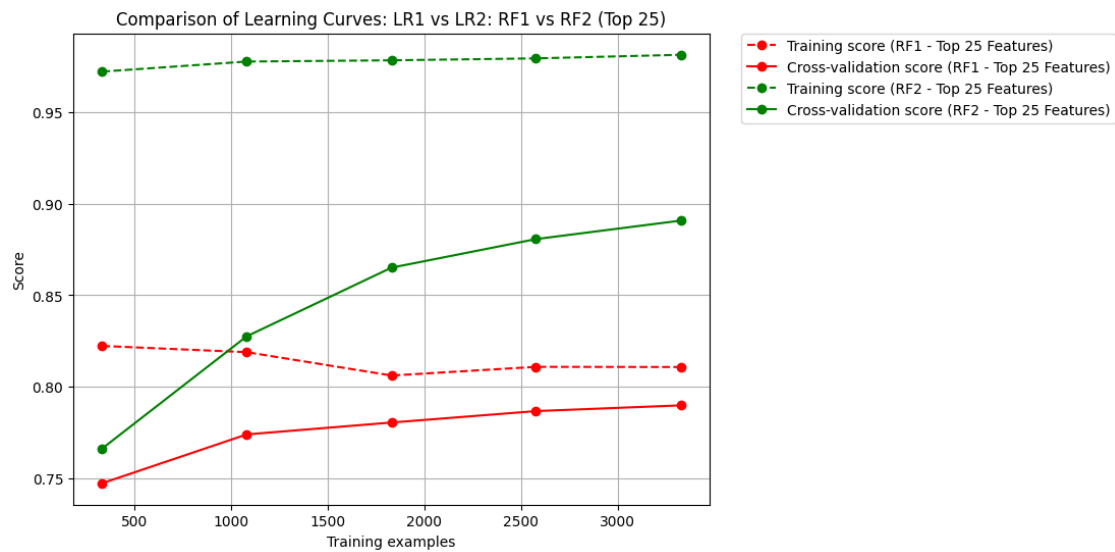
clf.plot_learning_curve_comparison(
    data_sets=data_to_plot_2,
    title="Comparison of Learning Curves: LR1 vs LR2: RF1 vs RF2 (Top 10)"
)

# Graph 3:
data_to_plot_2 = [
    (results_rf1['top_25_features']['model'], "RF1 - Top 25 Features",
    ↪results_rf1['top_25_features']['X'], results_rf1['top_25_features']['y']),
    (results_rf2['top_25_features']['model'], "RF2 - Top 25 Features",
    ↪results_rf2['top_25_features']['X'], results_rf2['top_25_features']['y'])
]

clf.plot_learning_curve_comparison(
    data_sets=data_to_plot_2,
    title="Comparison of Learning Curves: LR1 vs LR2: RF1 vs RF2 (Top 25)"
)

```





4 4) XGBC

```
[12]: xgbc_1, results_xgbc_1 = clf.XGBC(verbose=True)
```

```
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```

Bar chart showing the distribution of feature importance for the 'face' variable. The y-axis represents normalized importance from 0.000 to 0.125. The x-axis lists 100 features. The most important features are 'face_vertical_length_norm' (approx. 0.13), 'face_angle_norm' (approx. 0.055), and 'face_angle' (approx. 0.045). The importance decreases rapidly for subsequent features, with many features having importance below 0.01.

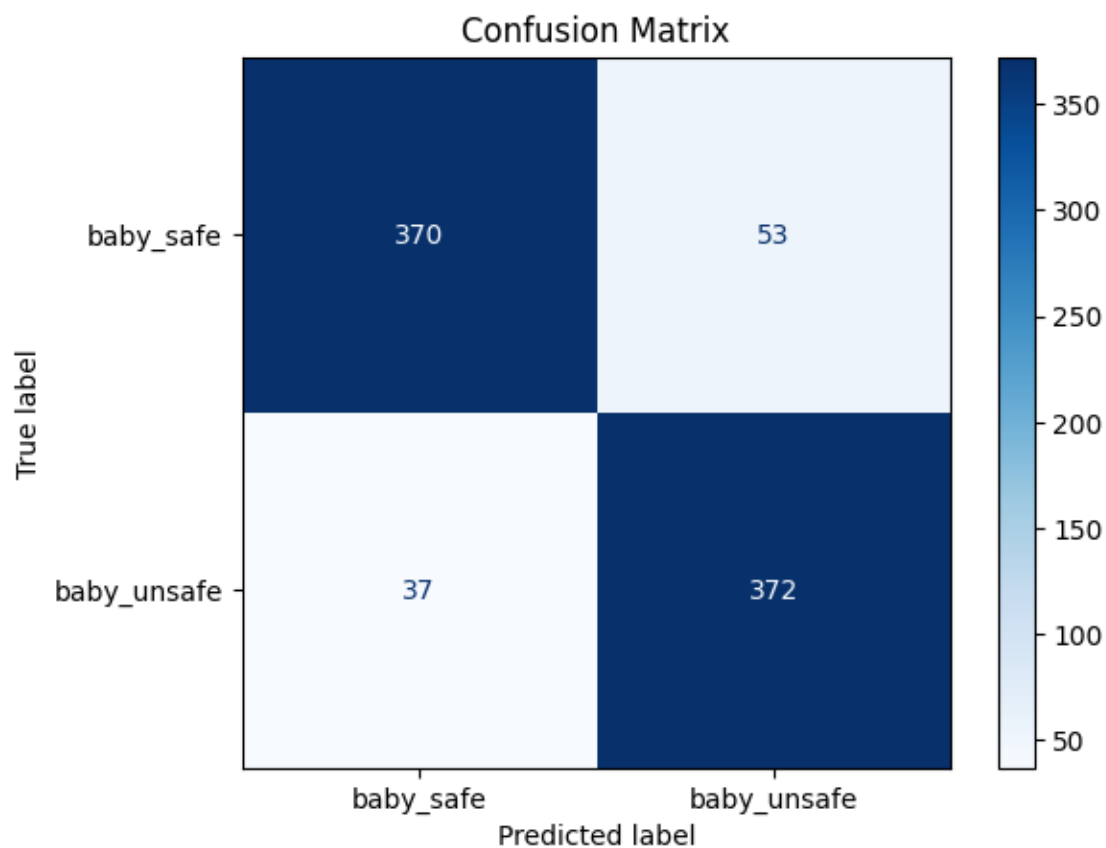


Dataset labels:-----
{'baby_safe': 0, 'baby_unsafe': 1}

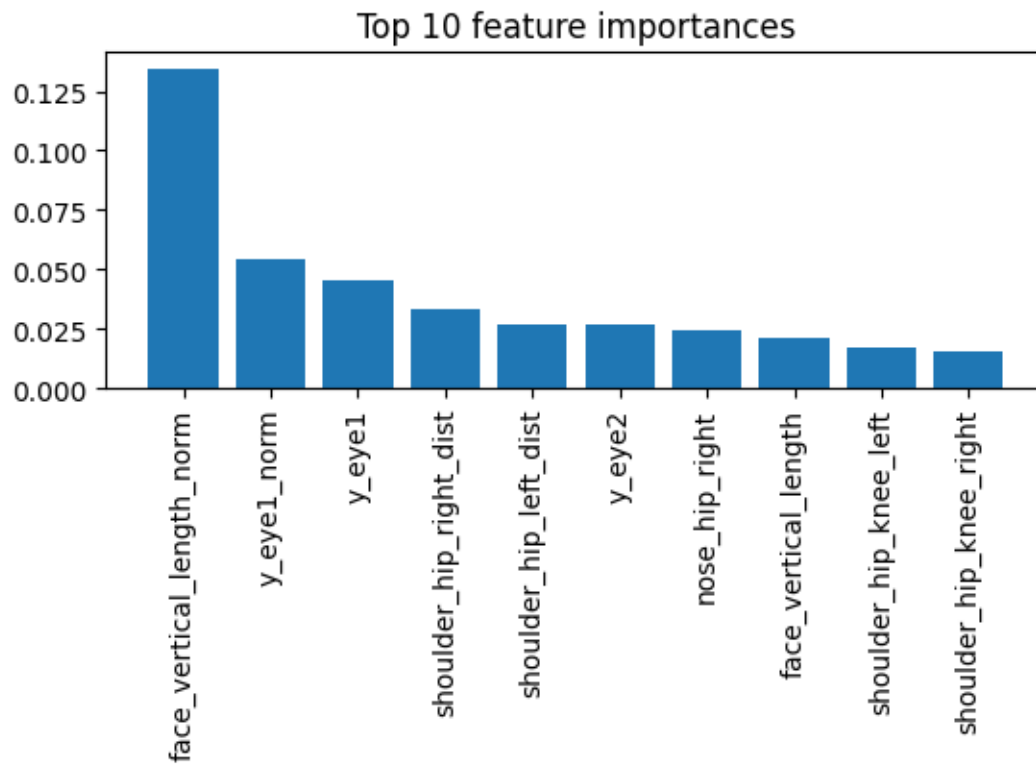
Report-----

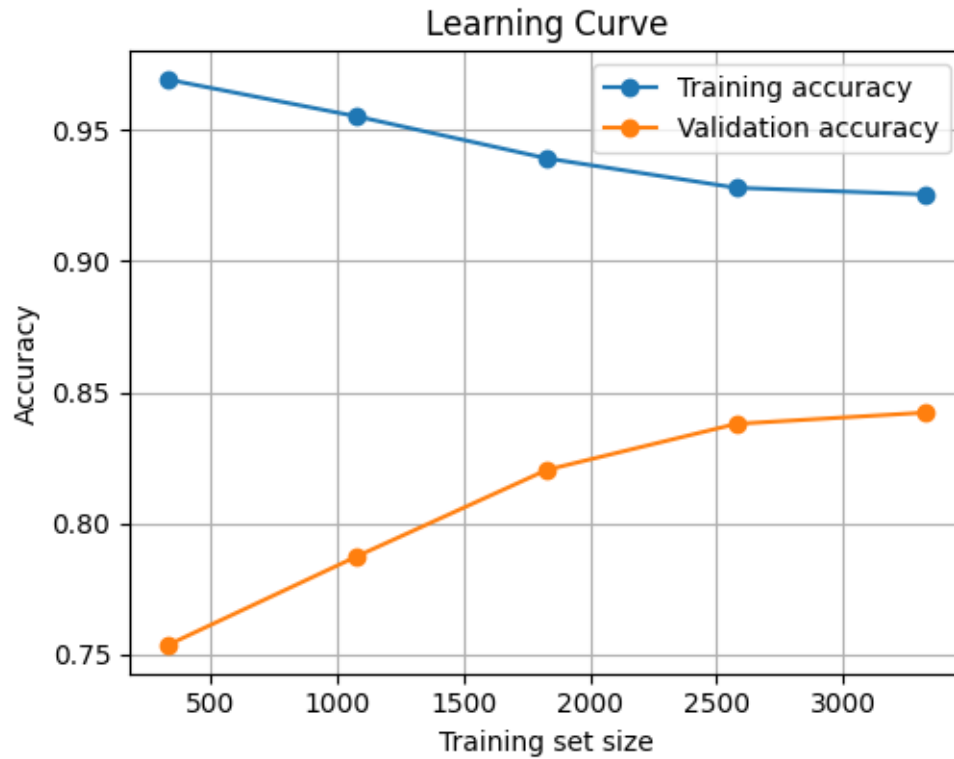
	precision	recall	f1-score	support
baby_safe	0.91	0.87	0.89	423
baby_unsafe	0.88	0.91	0.89	409
accuracy			0.89	832
macro avg	0.89	0.89	0.89	832
weighted avg	0.89	0.89	0.89	832

Confusion matrix-----



-----TOP 10 FEATURES
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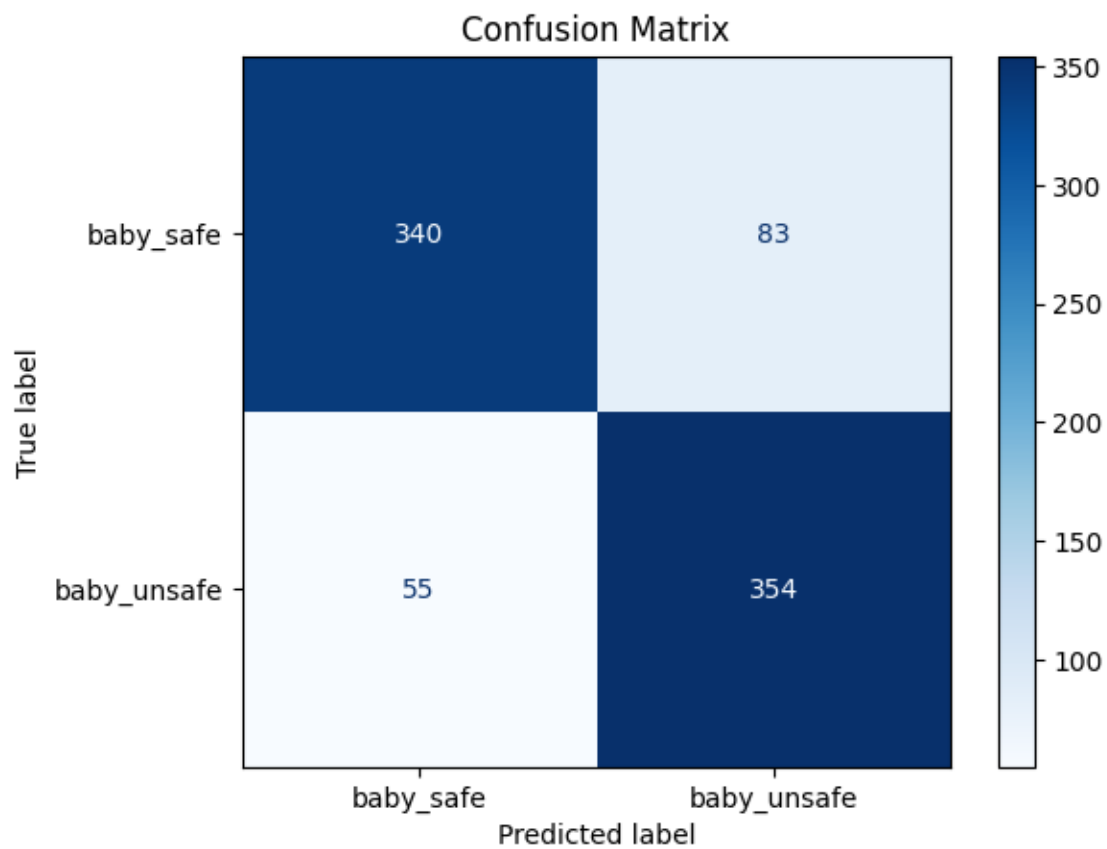
Dataset labels:-----

```
{'baby_safe': 0, 'baby_unsafe': 1}
```

Report-----

	precision	recall	f1-score	support
baby_safe	0.86	0.80	0.83	423
baby_unsafe	0.81	0.87	0.84	409
accuracy			0.83	832
macro avg	0.84	0.83	0.83	832
weighted avg	0.84	0.83	0.83	832

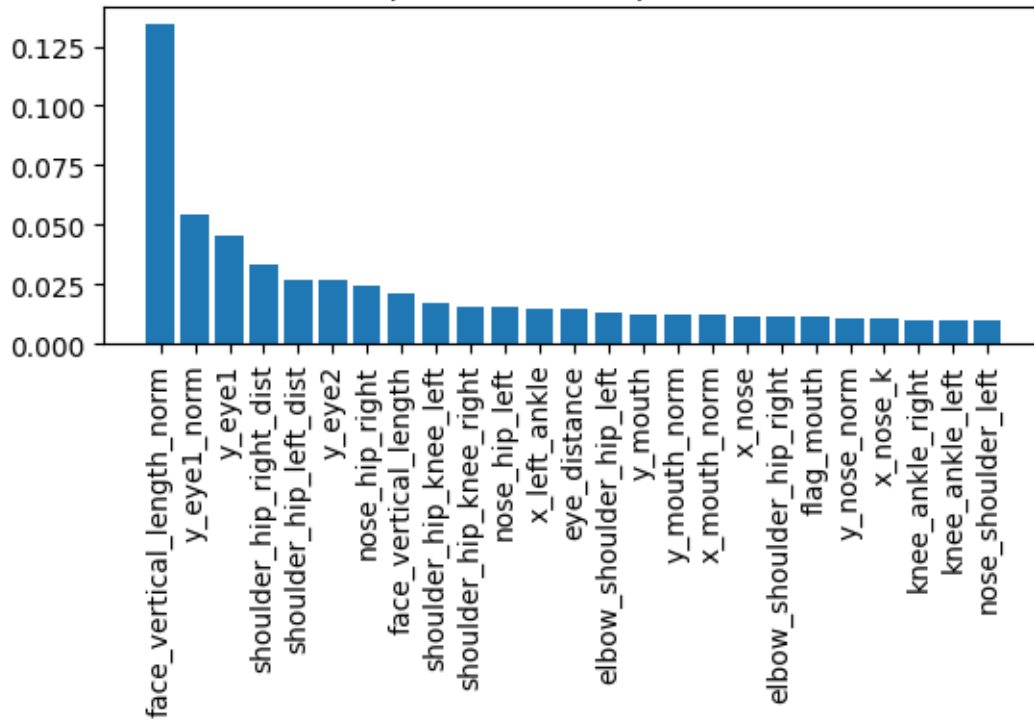
Confusion matrix-----



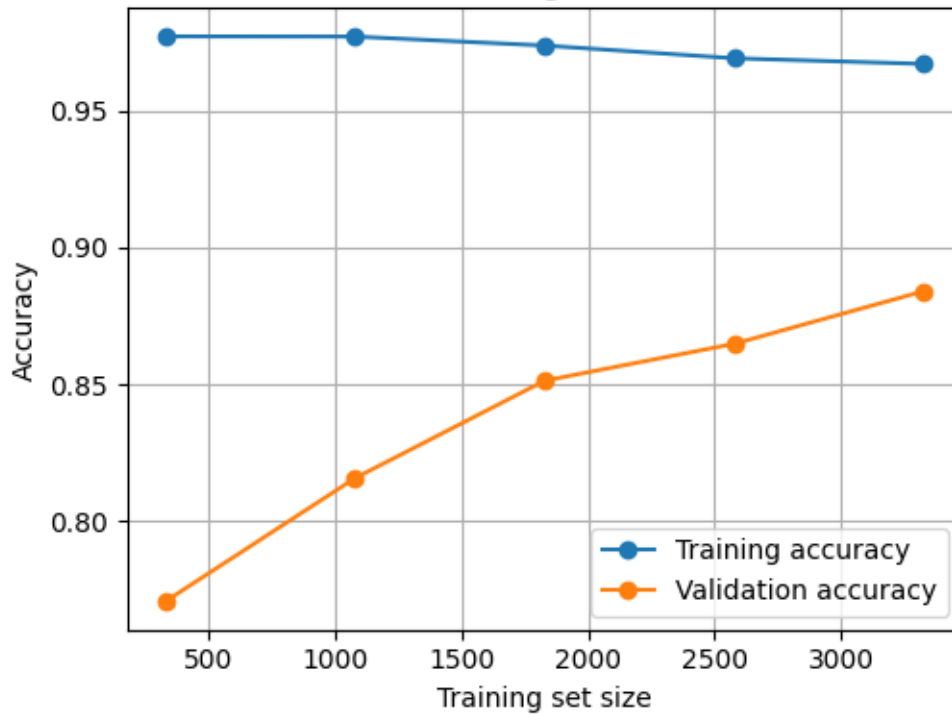
-----TOP 25 FEATURES

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Top 25 feature importances



Learning Curve

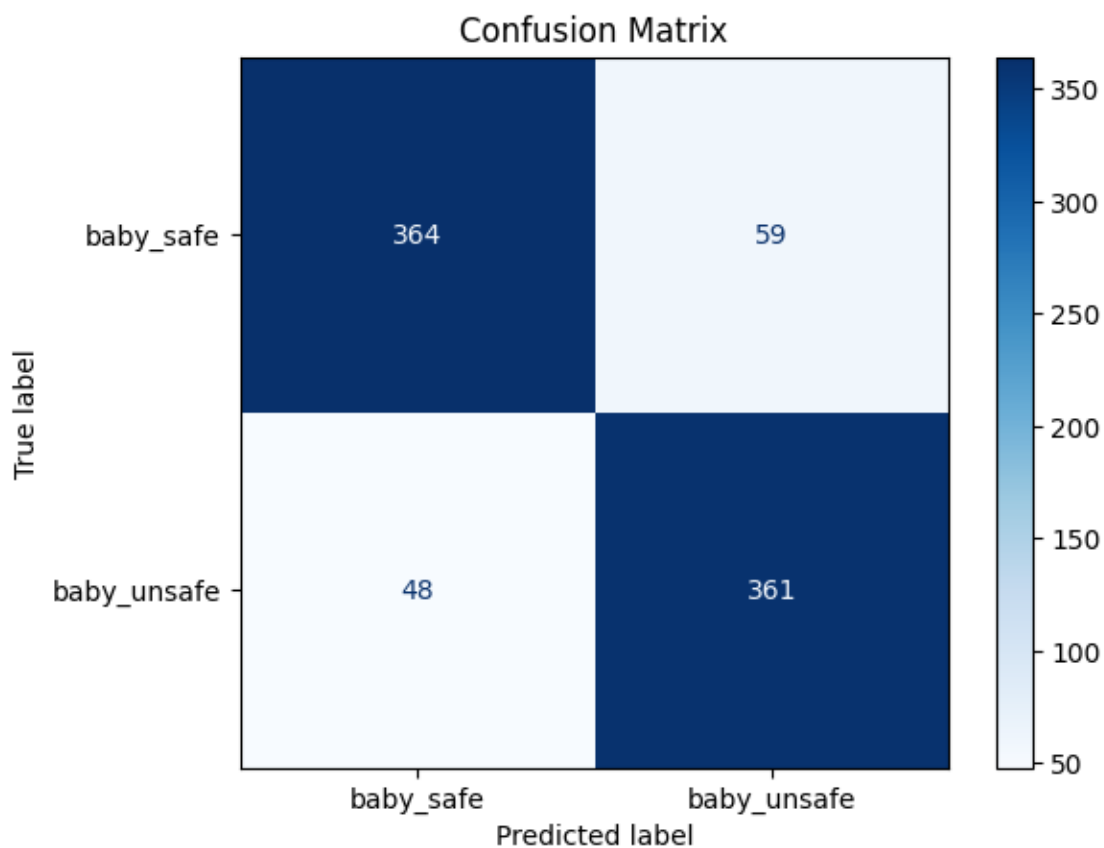


Dataset labels:-----
{'baby_safe': 0, 'baby_unsafe': 1}

Report-----

	precision	recall	f1-score	support
baby_safe	0.88	0.86	0.87	423
baby_unsafe	0.86	0.88	0.87	409
accuracy			0.87	832
macro avg	0.87	0.87	0.87	832
weighted avg	0.87	0.87	0.87	832

Confusion matrix-----



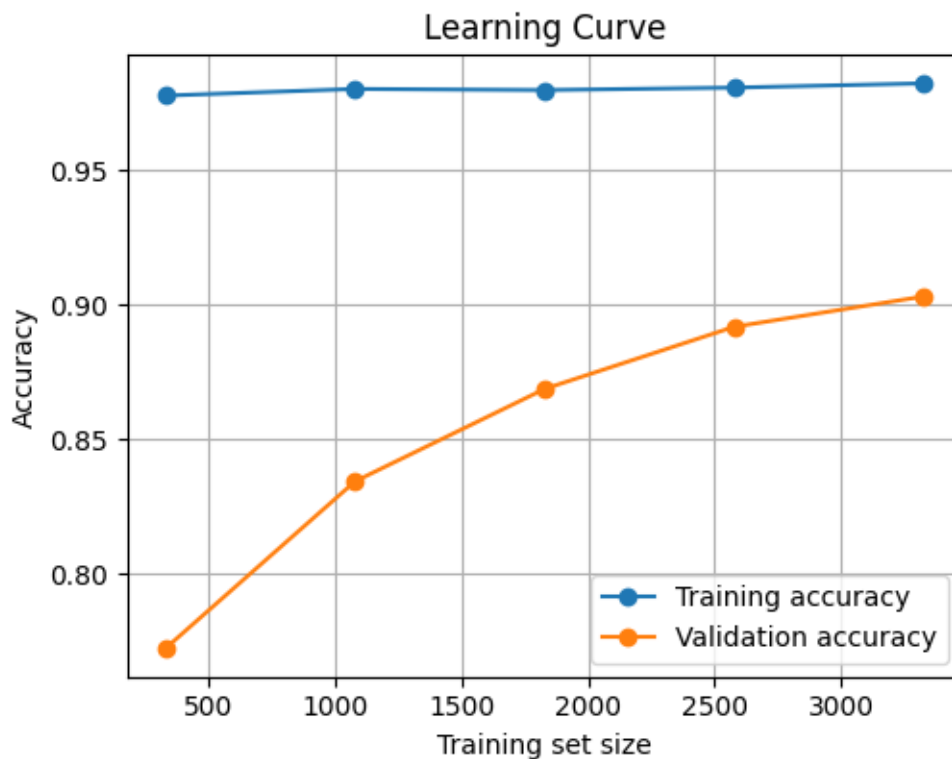
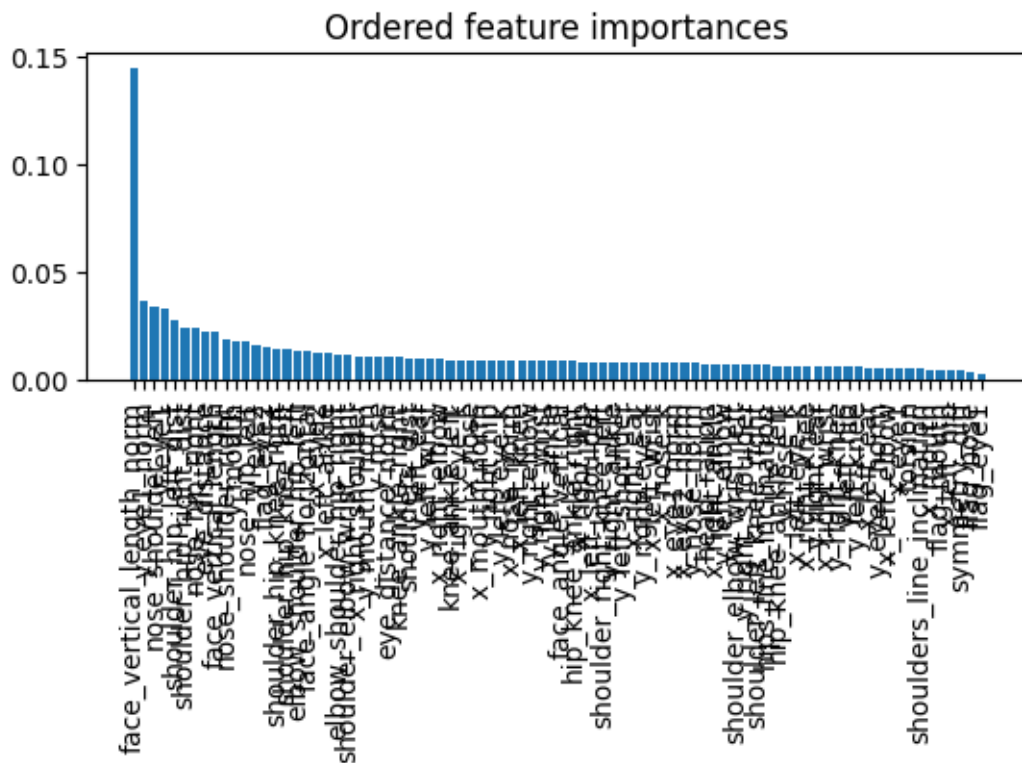
```
[13]: param_dist = {
    'n_estimators': randint(100, 500), # Numero di alberi da costruire
    'learning_rate': uniform(0.01, 0.3), # Passo di apprendimento
    'max_depth': randint(3, 10), # Profondità massima di un albero
    'subsample': uniform(0.6, 0.4), # Frazione di campioni da usare per
    ↳ l'addestramento
    'colsample_bytree': uniform(0.6, 0.4), # Frazione di feature da usare per
    ↳ la costruzione di ogni albero
    'gamma': uniform(0, 0.5) # Riduzione minima della perdita richiesta per
    ↳ fare un'ulteriore partizione
}
best_params_xgbc = clf.optimize_model(xgbc_1, param_dist, verbose=False)
xgbc_2 = XGBClassifier(**best_params_xgbc)
results_xgbc_2 = clf.evaluation_pipeline(xgbc_2, verbose=True)
```

Start random search...

Random Search Results:

Best parameters found: {'colsample_bytree': np.float64(0.8587393446674896),
'gamma': np.float64(0.1941341919949361), 'learning_rate':
np.float64(0.0788184237114849), 'max_depth': 6, 'n_estimators': 319,
'subsample': np.float64(0.7441380380821073)}
Best mean cross-validation accuracy: 0.8998771704034862

```
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```

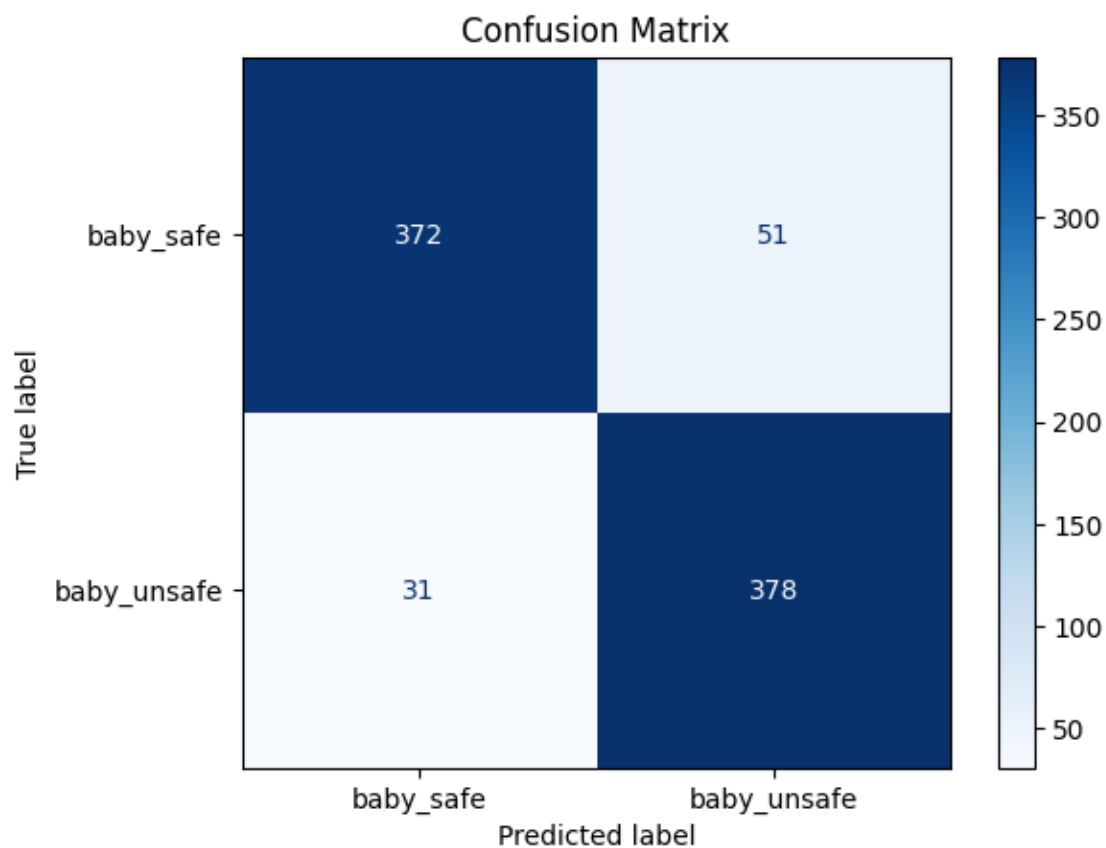


Dataset labels:-----
{'baby_safe': 0, 'baby_unsafe': 1}

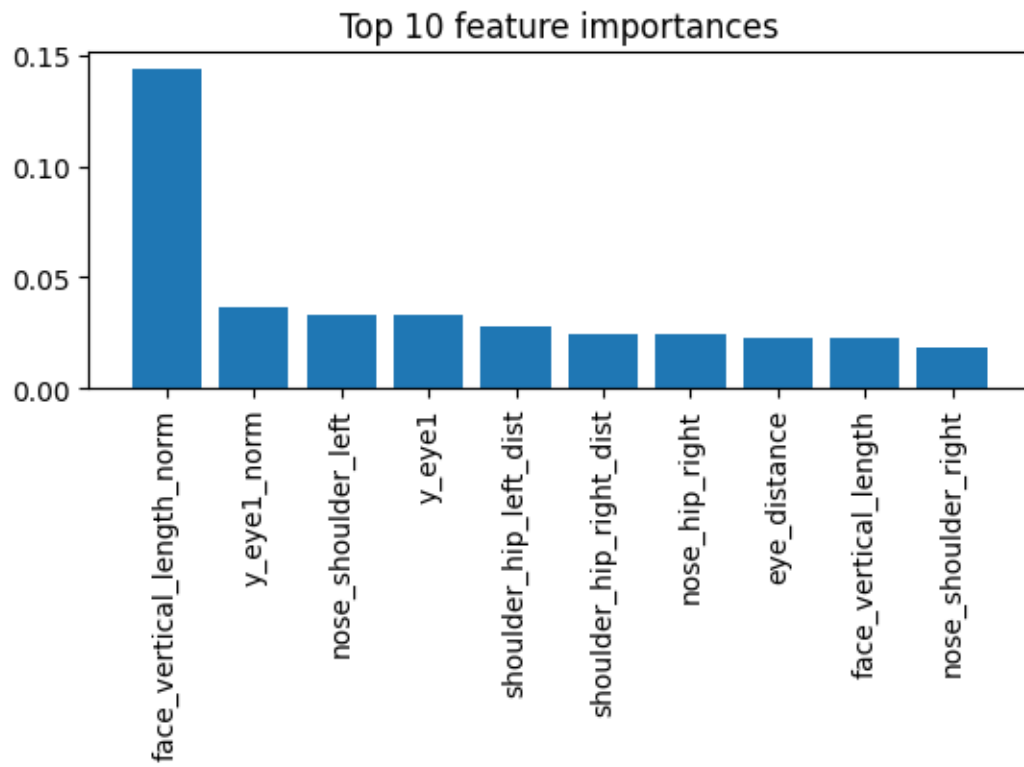
Report-----

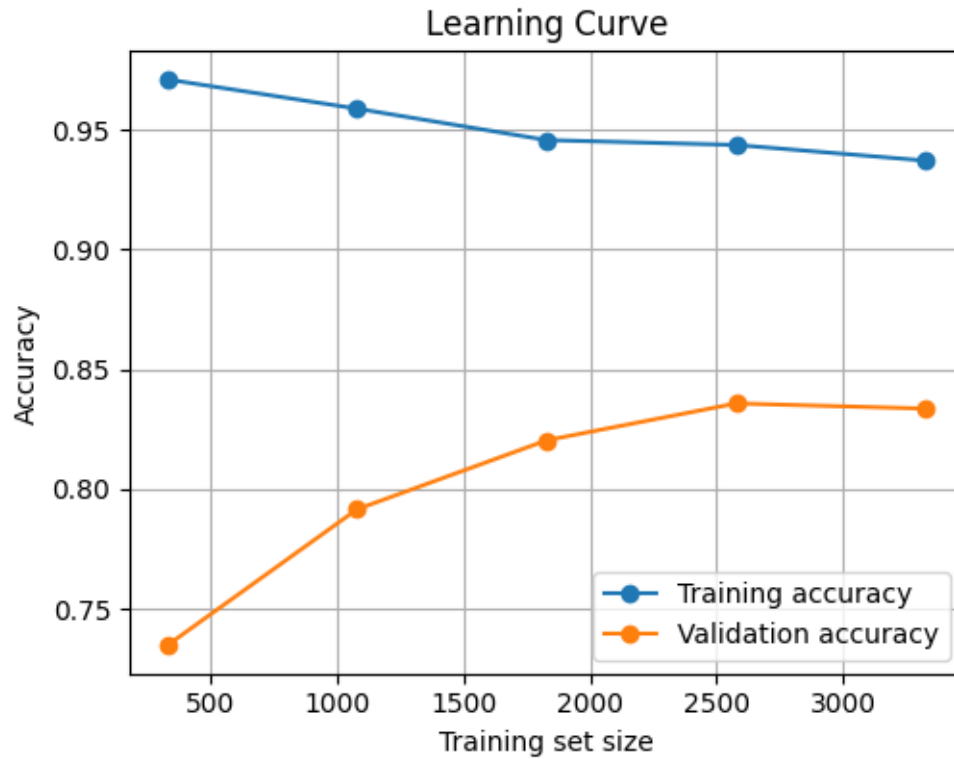
	precision	recall	f1-score	support
baby_safe	0.92	0.88	0.90	423
baby_unsafe	0.88	0.92	0.90	409
accuracy			0.90	832
macro avg	0.90	0.90	0.90	832
weighted avg	0.90	0.90	0.90	832

Confusion matrix-----



-----TOP 10 FEATURES
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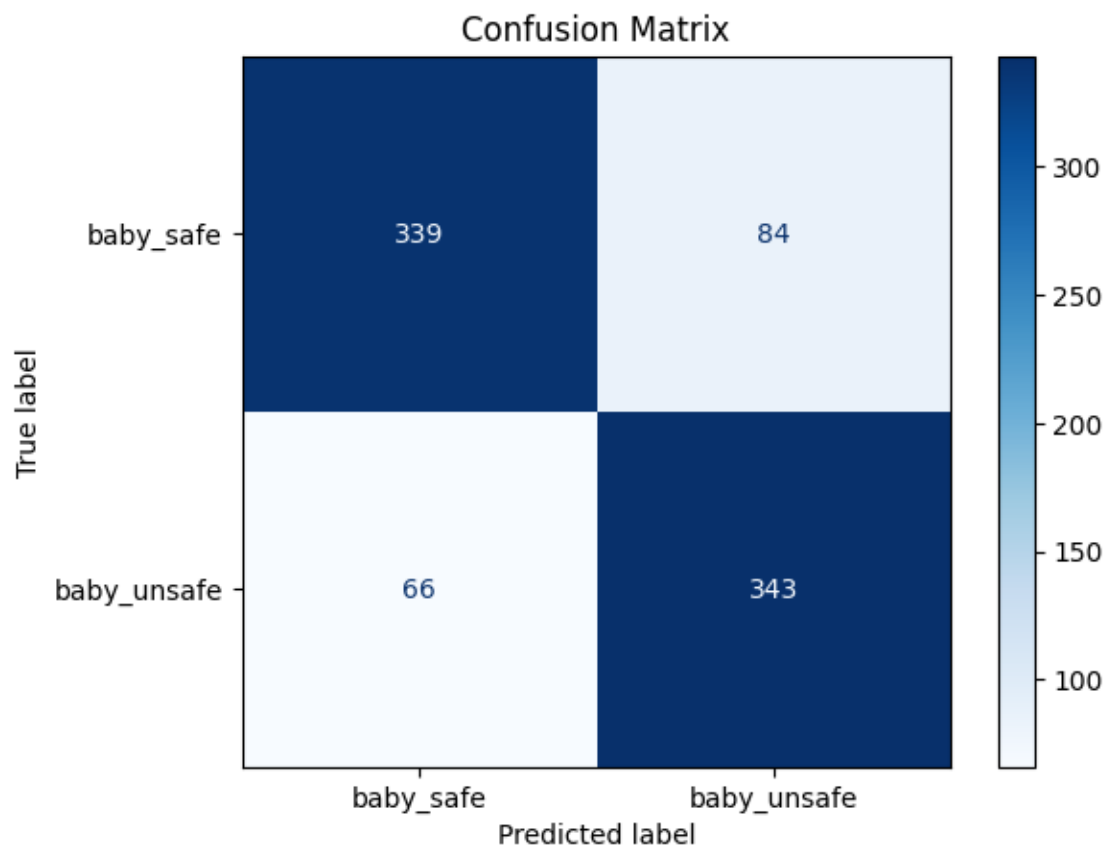
Dataset labels:-----

```
{'baby_safe': 0, 'baby_unsafe': 1}
```

Report-----

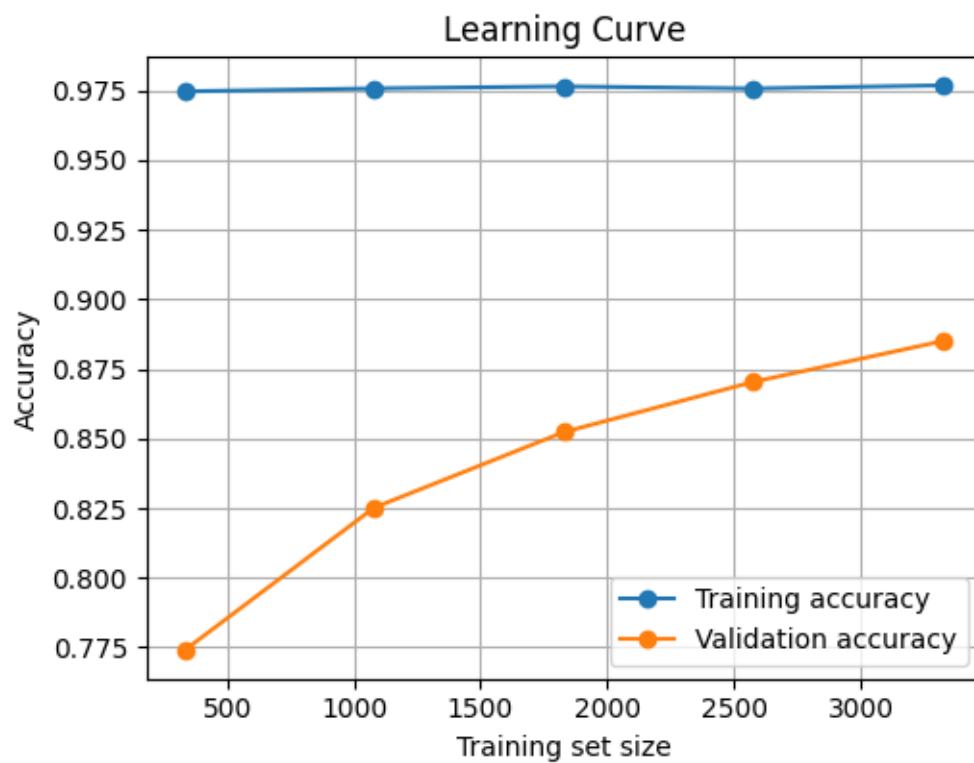
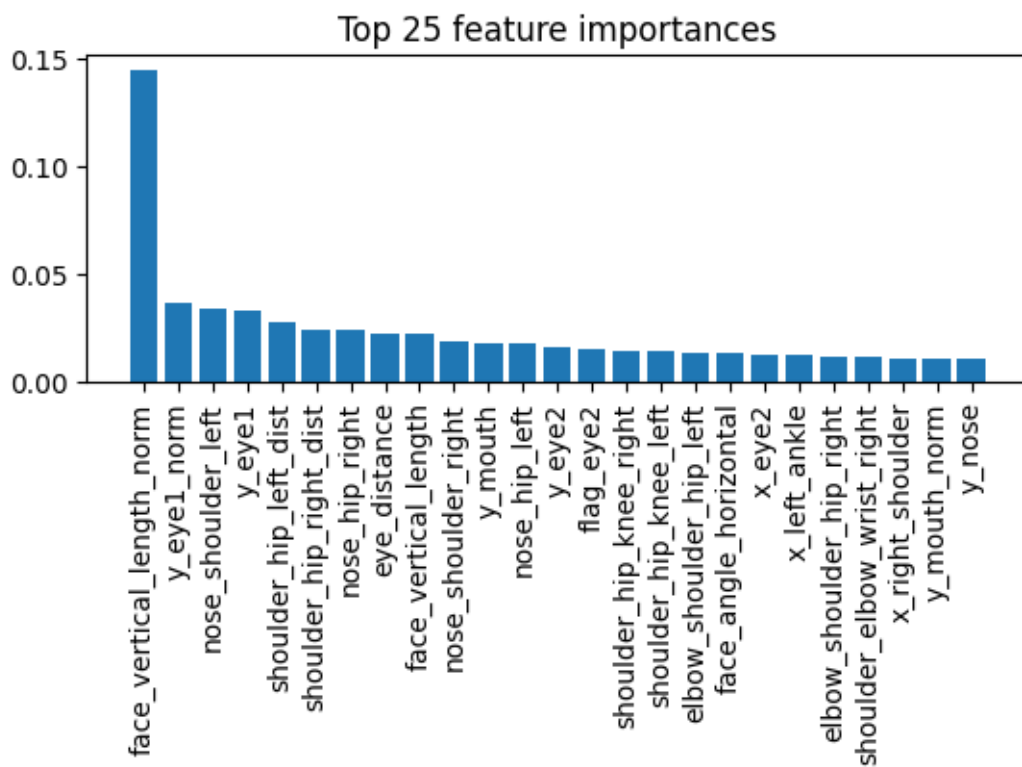
	precision	recall	f1-score	support
baby_safe	0.84	0.80	0.82	423
baby_unsafe	0.80	0.84	0.82	409
accuracy			0.82	832
macro avg	0.82	0.82	0.82	832
weighted avg	0.82	0.82	0.82	832

Confusion matrix-----



-----TOP 25 FEATURES

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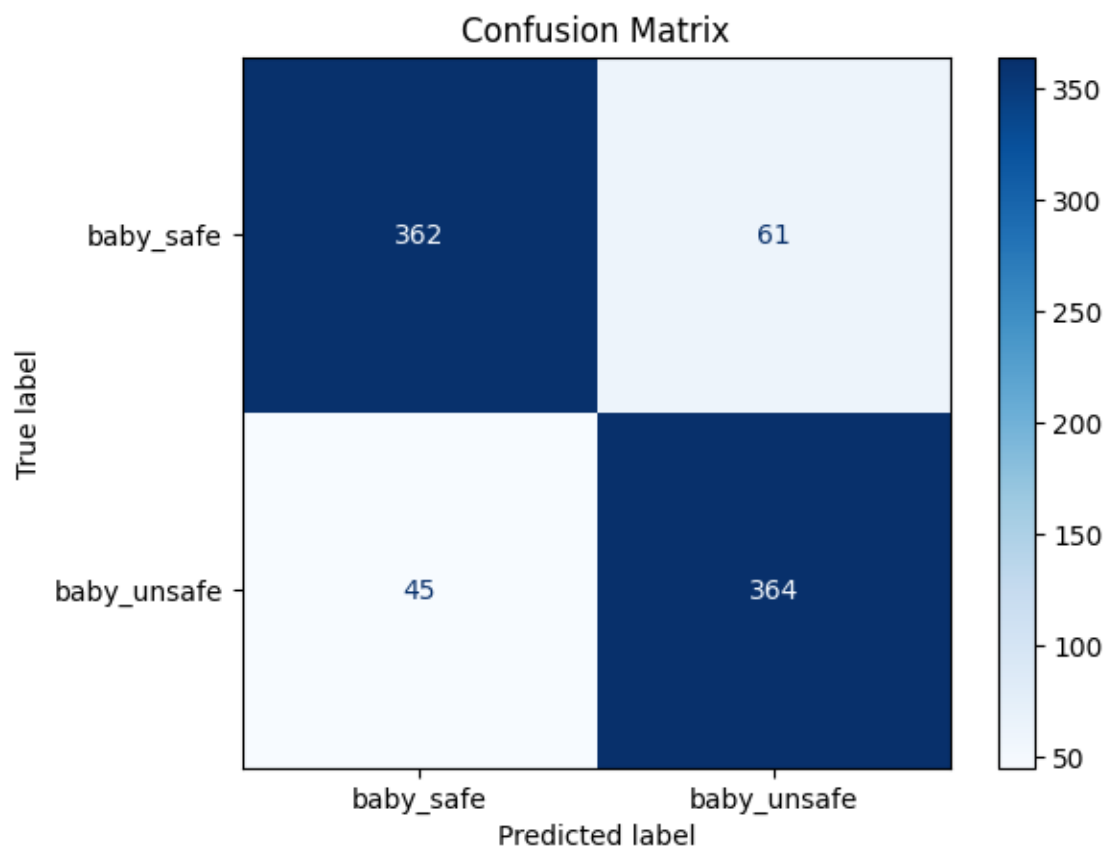


Dataset labels:-----
{'baby_safe': 0, 'baby_unsafe': 1}

Report-----

	precision	recall	f1-score	support
baby_safe	0.89	0.86	0.87	423
baby_unsafe	0.86	0.89	0.87	409
accuracy			0.87	832
macro avg	0.87	0.87	0.87	832
weighted avg	0.87	0.87	0.87	832

Confusion matrix-----



```

[14]: # Graph 1:
data_to_plot_1 = [
    (results_xgbc_1['all_features']['model'], "xgbc_1 - All Features",
    ↪results_xgbc_1['all_features']['X'], results_xgbc_1['all_features']['y']),
    (results_xgbc_2['all_features']['model'], "xgbc_2 - All Features",
    ↪results_xgbc_2['all_features']['X'], results_xgbc_2['all_features']['y'])
]

clf.plot_learning_curve_comparison(
    data_sets=data_to_plot_1,
    title="Comparison of Learning Curves: XGBC_1 vs XGBC_2"
)

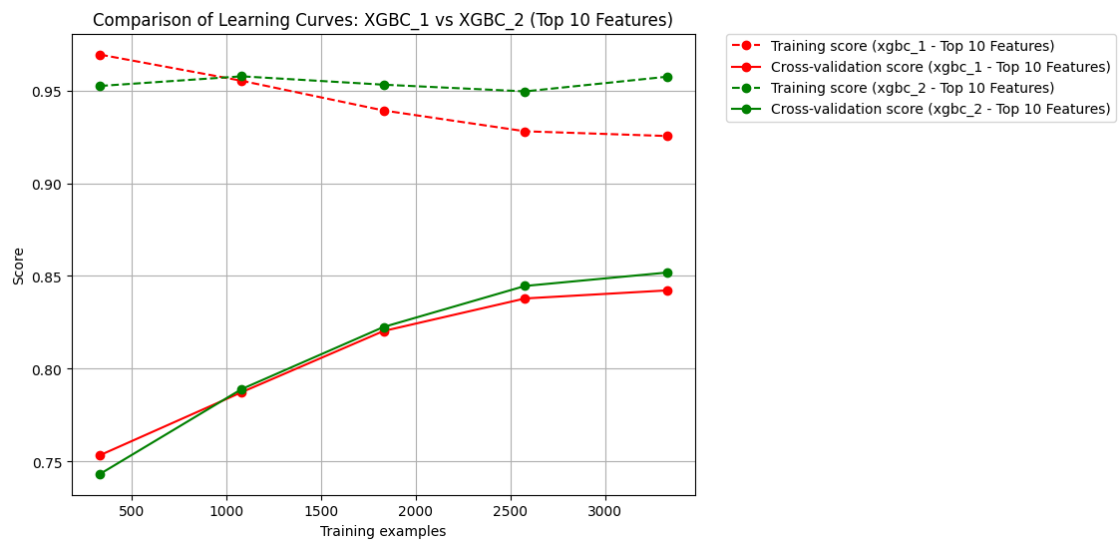
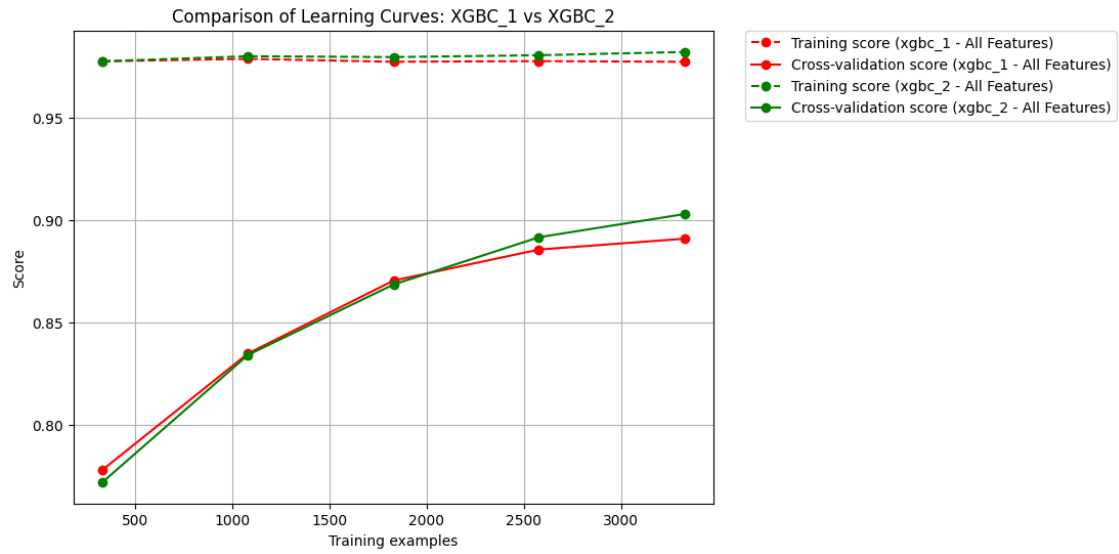
# Graph 2:
data_to_plot_2 = [
    (results_xgbc_1['top_10_features']['model'], "xgbc_1 - Top 10 Features",
    ↪results_xgbc_1['top_10_features']['X'],
    ↪results_xgbc_1['top_10_features']['y']),
    (results_rf2['top_10_features']['model'], "xgbc_2 - Top 10 Features",
    ↪results_xgbc_2['top_10_features']['X'],
    ↪results_xgbc_2['top_10_features']['y'])
]

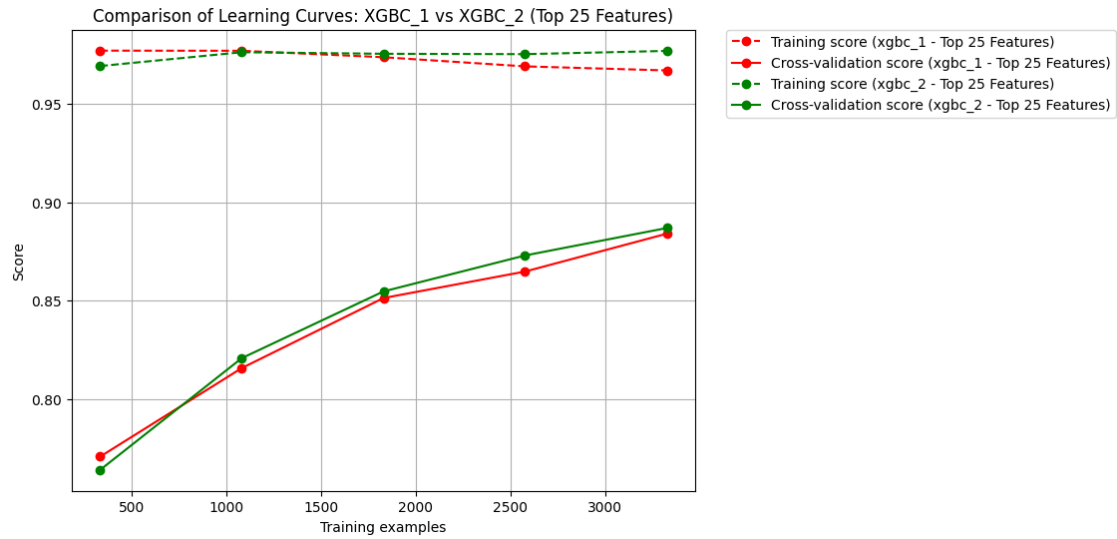
clf.plot_learning_curve_comparison(
    data_sets=data_to_plot_2,
    title="Comparison of Learning Curves: XGBC_1 vs XGBC_2 (Top 10 Features)"
)

# Graph 3:
data_to_plot_2 = [
    (results_xgbc_1['top_25_features']['model'], "xgbc_1 - Top 25 Features",
    ↪results_xgbc_1['top_25_features']['X'],
    ↪results_xgbc_1['top_25_features']['y']),
    (results_rf2['top_25_features']['model'], "xgbc_2 - Top 25 Features",
    ↪results_xgbc_2['top_25_features']['X'],
    ↪results_xgbc_2['top_25_features']['y'])
]

clf.plot_learning_curve_comparison(
    data_sets=data_to_plot_2,
    title="Comparison of Learning Curves: XGBC_1 vs XGBC_2 (Top 25 Features)"
)

```

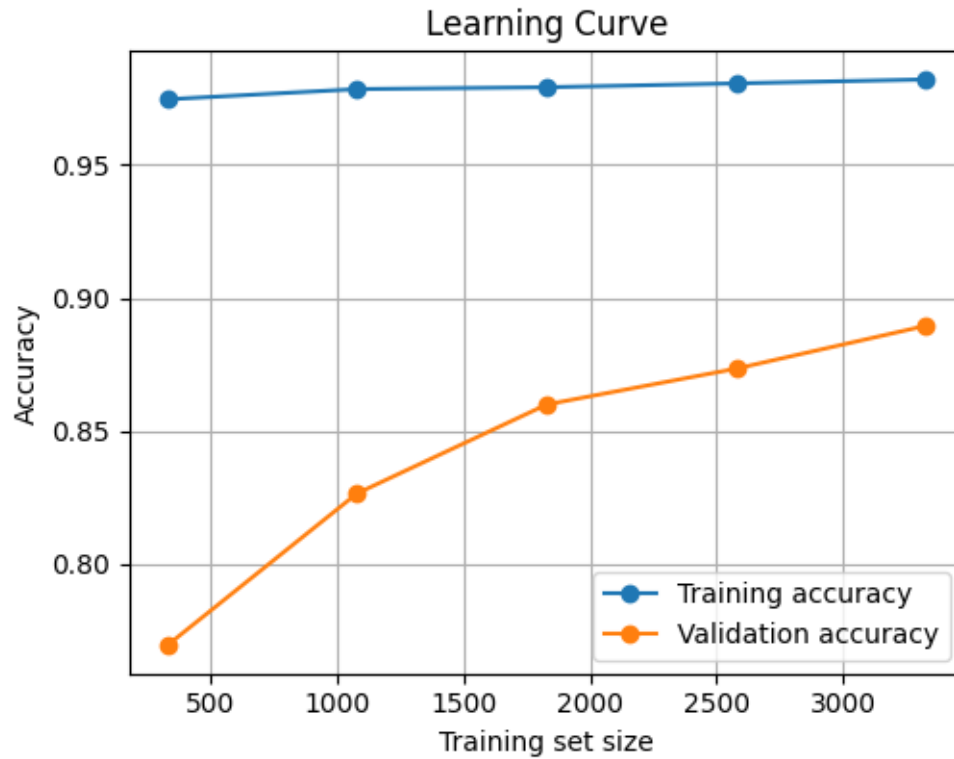




5 5) Bagging

```
[15]: from sklearn.tree import DecisionTreeClassifier
      from sklearn.ensemble import BaggingClassifier
      base_clf = DecisionTreeClassifier(random_state=42)
      bagging_1, results_bag_1 = clf.bagging(base_clf=base_clf, verbose=True)
```


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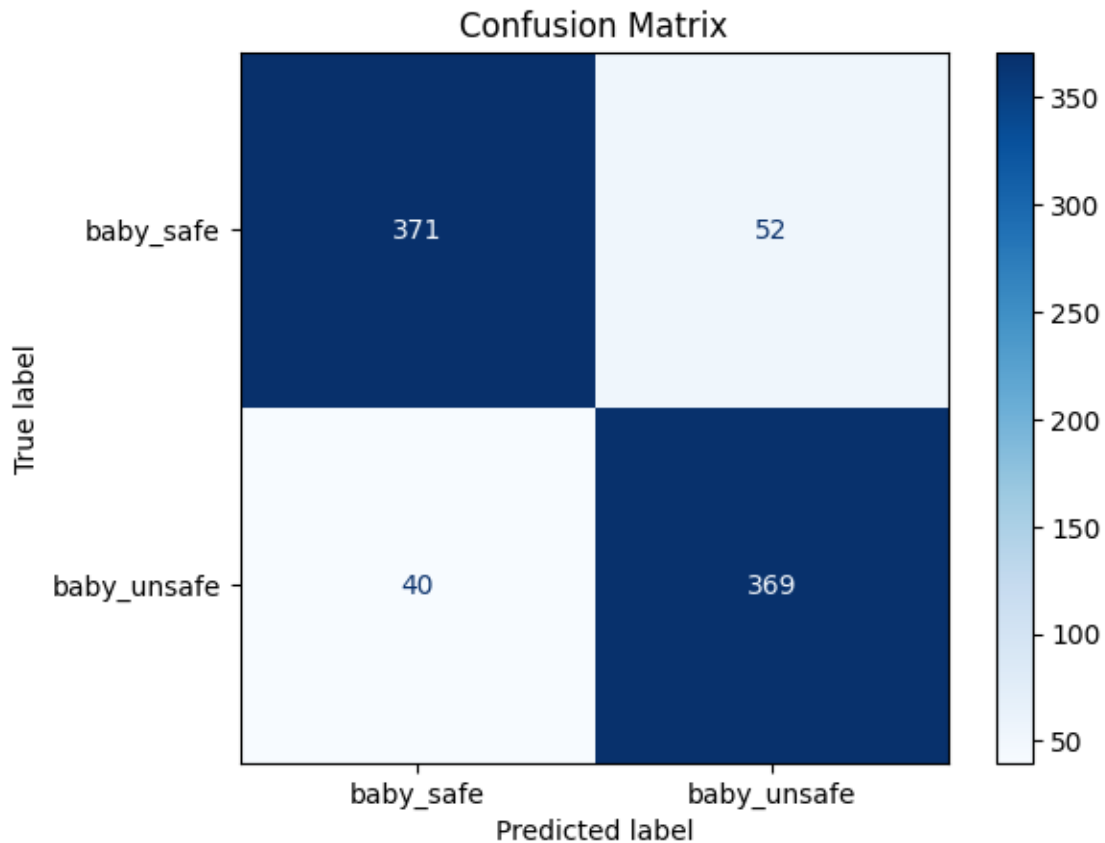
Dataset labels:-----

```
{'baby_safe': 0, 'baby_unsafe': 1}
```

Report-----

	precision	recall	f1-score	support
baby_safe	0.90	0.88	0.89	423
baby_unsafe	0.88	0.90	0.89	409
accuracy			0.89	832
macro avg	0.89	0.89	0.89	832
weighted avg	0.89	0.89	0.89	832

Confusion matrix-----



```
[16]: # Definisci il dizionario dei parametri per la ricerca casuale
param_grid = {
    'n_estimators': randint(100, 500),
    'max_samples': uniform(0.5, 1),
    'max_features': uniform(0.5, 1),
    'bootstrap_features': [True, False],
    'estimator__max_depth': randint(1, 30),
    'estimator__min_samples_split': randint(2, 20)
}

best_params_bagging = clf.optimize_model(model=bagging_1,
    param_grid=param_grid, verbose=False)

dt_params = {
    'max_depth': best_params_bagging.pop('estimator__max_depth'),
    'min_samples_split': best_params_bagging.pop('estimator__min_samples_split')
}

bagging_2 = BaggingClassifier(
```

```
estimator=DecisionTreeClassifier(random_state=42,**dt_params),
**best_params_bagging)

results_bagging_2 = clf.evaluation_pipeline(bagging_2,verbose=True)
```

Start random search...

/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-packages/sklearn/model_selection/_validation.py:516: FitFailedWarning:
745 fits failed out of a total of 1000.
The score on these train-test partitions for these parameters will be set to nan.
If these failures are not expected, you can try to debug them by setting error_score='raise'.

Below are more details about the failures:

5 fits failed with the following error:
Traceback (most recent call last):
 File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
 estimator.fit(X_train, y_train, **fit_params)
 File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-packages/sklearn/base.py", line 1358, in wrapper
 estimator._validate_params()
 File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-packages/sklearn/base.py", line 471, in _validate_params
 validate_parameter_constraints(
 File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-packages/sklearn/utils/_param_validation.py", line 98, in validate_parameter_constraints
 raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features' parameter of BaggingClassifier must be an int in the range [1, inf) or a float in the range (0.0, 1.0]. Got np.float64(1.231993941811405) instead.

5 fits failed with the following error:
Traceback (most recent call last):
 File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
 estimator.fit(X_train, y_train, **fit_params)
 File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-packages/sklearn/base.py", line 1358, in wrapper
 estimator._validate_params()
 File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-packages/sklearn/base.py", line 471, in _validate_params

```
    validate_parameter_constraints(
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.2219987722668249) instead.
```

5 fits failed with the following error:

Traceback (most recent call last):

```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
    estimator.fit(X_train, y_train, **fit_params)
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 1358, in wrapper
    estimator._validate_params()
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 471, in _validate_params
    validate_parameter_constraints(
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_samples'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.024756431632238) instead.
```

5 fits failed with the following error:

Traceback (most recent call last):

```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
    estimator.fit(X_train, y_train, **fit_params)
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 1358, in wrapper
    estimator._validate_params()
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 471, in _validate_params
    validate_parameter_constraints(
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_samples'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.4737555188414593) instead.
```

```
5 fits failed with the following error:
Traceback (most recent call last):
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
    estimator.fit(X_train, y_train, **fit_params)
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 1358, in wrapper
    estimator._validate_params()
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 471, in _validate_params
    validate_parameter_constraints(
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.0142344384136117) instead.
```

```
5 fits failed with the following error:
Traceback (most recent call last):
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
    estimator.fit(X_train, y_train, **fit_params)
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 1358, in wrapper
    estimator._validate_params()
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 471, in _validate_params
    validate_parameter_constraints(
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.3083973481164612) instead.
```

```
5 fits failed with the following error:
Traceback (most recent call last):
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
    estimator.fit(X_train, y_train, **fit_params)
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
```

```
packages/sklearn/base.py", line 1358, in wrapper
    estimator._validate_params()
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 471, in _validate_params
    validate_parameter_constraints(
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.1832635188254583) instead.
```

5 fits failed with the following error:

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```
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
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parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.0677003278199915) instead.
```

5 fits failed with the following error:

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  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
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validate_parameter_constraints
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```
raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.394827350427649) instead.
```

5 fits failed with the following error:

Traceback (most recent call last):

```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
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validate_parameter_constraints
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```
sklearn.utils._param_validation.InvalidParameterError: The 'max_samples'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.3287375091519293) instead.
```

```
sklearn.utils._param_validation.InvalidParameterError: The 'max_samples'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.3287375091519293) instead.
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```

```
sklearn.utils._param_validation.InvalidParameterError: The 'max_samples'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.3021969807540397) instead.
```

```
sklearn.utils._param_validation.InvalidParameterError: The 'max_samples'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.3021969807540397) instead.
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validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.2722447692966574) instead.
```

5 fits failed with the following error:

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```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
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packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.21134195274865) instead.
```

5 fits failed with the following error:

Traceback (most recent call last):

```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
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validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.1510770255019445) instead.
```

5 fits failed with the following error:

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```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
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    validate_parameter_constraints(
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packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.091297787707727) instead.
```

5 fits failed with the following error:

Traceback (most recent call last):

```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
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validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.4717120953891039) instead.
```

```
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  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
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packages/sklearn/utils/_param_validation.py", line 98, in
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    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_samples'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.0227328293819942) instead.
```

```
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  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
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sklearn.utils._param_validation.InvalidParameterError: The 'max_samples'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.3957635956735195) instead.
```

```
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packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.4075664739260931) instead.
```

5 fits failed with the following error:

Traceback (most recent call last):

```
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
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    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.442853570557981) instead.
```

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Traceback (most recent call last):

```
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
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```
raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.1243540481337932) instead.
```

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Traceback (most recent call last):

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sklearn.utils._param_validation.InvalidParameterError: The 'max_samples'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.3925589984899778) instead.
```

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sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
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```

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File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
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    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.3607305832563434) instead.

```

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```

File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
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validate_parameter_constraints
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sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.212270589924442) instead.

```

5 fits failed with the following error:

Traceback (most recent call last):

```

File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
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```

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sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.0026790232288616) instead.
```

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File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
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sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
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```

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```
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File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.1323058305935794) instead.
```

```
5 fits failed with the following error:
Traceback (most recent call last):
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
    estimator.fit(X_train, y_train, **fit_params)
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 1358, in wrapper
    estimator._validate_params()
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 471, in _validate_params
    validate_parameter_constraints(
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.335302495589238) instead.
```

```
5 fits failed with the following error:
Traceback (most recent call last):
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
    estimator.fit(X_train, y_train, **fit_params)
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
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    estimator._validate_params()
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 471, in _validate_params
    validate_parameter_constraints(
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.090892943188242) instead.
```

```
5 fits failed with the following error:
Traceback (most recent call last):
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
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  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
```



```
packages/sklearn/base.py", line 1358, in wrapper
    estimator._validate_params()
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 471, in _validate_params
    validate_parameter_constraints(
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_samples'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.190937738102466) instead.
```

5 fits failed with the following error:

Traceback (most recent call last):

```
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
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    estimator._validate_params()
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 471, in _validate_params
    validate_parameter_constraints(
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_samples'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.2003578299727713) instead.
```

5 fits failed with the following error:

Traceback (most recent call last):

```
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
    estimator.fit(X_train, y_train, **fit_params)
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 1358, in wrapper
    estimator._validate_params()
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 471, in _validate_params
    validate_parameter_constraints(
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
```

```
raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.1420316461542876) instead.
```

5 fits failed with the following error:

Traceback (most recent call last):

```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
    estimator.fit(X_train, y_train, **fit_params)
```

```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
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```

```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 471, in _validate_params
    validate_parameter_constraints(
```

```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
```

```
raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_samples'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.1635017691080558) instead.
```

5 fits failed with the following error:

Traceback (most recent call last):

```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
    estimator.fit(X_train, y_train, **fit_params)
```

```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 1358, in wrapper
    estimator._validate_params()
```

```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 471, in _validate_params
    validate_parameter_constraints(
```

```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
```

```
raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.1576128923003433) instead.
```

5 fits failed with the following error:

Traceback (most recent call last):

```

File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
    estimator.fit(X_train, y_train, **fit_params)
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 1358, in wrapper
    estimator._validate_params()
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 471, in _validate_params
    validate_parameter_constraints(
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.0898708475605439) instead.

```

5 fits failed with the following error:

Traceback (most recent call last):

```

File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
    estimator.fit(X_train, y_train, **fit_params)
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 1358, in wrapper
    estimator._validate_params()
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 471, in _validate_params
    validate_parameter_constraints(
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_samples'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.1451033620305648) instead.

```

5 fits failed with the following error:

Traceback (most recent call last):

```

File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
    estimator.fit(X_train, y_train, **fit_params)
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 1358, in wrapper
    estimator._validate_params()
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 471, in _validate_params

```

```
    validate_parameter_constraints(
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.4945505107973411) instead.
```

5 fits failed with the following error:

Traceback (most recent call last):

```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
    estimator.fit(X_train, y_train, **fit_params)
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 1358, in wrapper
    estimator._validate_params()
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 471, in _validate_params
    validate_parameter_constraints(
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.247718773897414) instead.
```

5 fits failed with the following error:

Traceback (most recent call last):

```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
    estimator.fit(X_train, y_train, **fit_params)
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 1358, in wrapper
    estimator._validate_params()
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 471, in _validate_params
    validate_parameter_constraints(
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.4803315837160458) instead.
```

```
5 fits failed with the following error:
Traceback (most recent call last):
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
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  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
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    estimator._validate_params()
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 471, in _validate_params
    validate_parameter_constraints(
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.070061170089365) instead.
```

```
5 fits failed with the following error:
Traceback (most recent call last):
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
    estimator.fit(X_train, y_train, **fit_params)
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 1358, in wrapper
    estimator._validate_params()
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 471, in _validate_params
    validate_parameter_constraints(
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.2024840839871094) instead.
```

```
5 fits failed with the following error:
Traceback (most recent call last):
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
    estimator.fit(X_train, y_train, **fit_params)
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
```

```
packages/sklearn/base.py", line 1358, in wrapper
    estimator._validate_params()
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 471, in _validate_params
    validate_parameter_constraints(
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_samples'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.1115137108656805) instead.
```

5 fits failed with the following error:

Traceback (most recent call last):

```
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
    estimator.fit(X_train, y_train, **fit_params)
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 1358, in wrapper
    estimator._validate_params()
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 471, in _validate_params
    validate_parameter_constraints(
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.2982951789667752) instead.
```

5 fits failed with the following error:

Traceback (most recent call last):

```
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
    estimator.fit(X_train, y_train, **fit_params)
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 1358, in wrapper
    estimator._validate_params()
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 471, in _validate_params
    validate_parameter_constraints(
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
```

```
raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_samples'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.3226005606596583) instead.
```

5 fits failed with the following error:

Traceback (most recent call last):

```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
    estimator.fit(X_train, y_train, **fit_params)
```

```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 1358, in wrapper
    estimator._validate_params()
```

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packages/sklearn/base.py", line 471, in _validate_params
    validate_parameter_constraints(
```

```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
```

```
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.0222432600548044) instead.
```

5 fits failed with the following error:

Traceback (most recent call last):

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```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
    estimator.fit(X_train, y_train, **fit_params)
```

```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
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    estimator._validate_params()
```

```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 471, in _validate_params
    validate_parameter_constraints(
```

```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
```

```
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.3420230750119813) instead.
```

5 fits failed with the following error:

Traceback (most recent call last):

```
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.3420230750119813) instead.
```

5 fits failed with the following error:

Traceback (most recent call last):

```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
    estimator.fit(X_train, y_train, **fit_params)
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 1358, in wrapper
    estimator._validate_params()
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 471, in _validate_params
    validate_parameter_constraints(
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.2260913337226615) instead.
```

5 fits failed with the following error:

Traceback (most recent call last):

```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
    estimator.fit(X_train, y_train, **fit_params)
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 1358, in wrapper
    estimator._validate_params()
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 471, in _validate_params
    validate_parameter_constraints(
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_samples'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.4346139973397096) instead.
```

5 fits failed with the following error:

Traceback (most recent call last):

```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
    estimator.fit(X_train, y_train, **fit_params)
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 1358, in wrapper
    estimator._validate_params()
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 471, in _validate_params
```



```

    validate_parameter_constraints(
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.1571113285001668) instead.

```

5 fits failed with the following error:

Traceback (most recent call last):

```

File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
    estimator.fit(X_train, y_train, **fit_params)
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 1358, in wrapper
    estimator._validate_params()
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 471, in _validate_params
    validate_parameter_constraints(
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.0660372104940763) instead.

```

5 fits failed with the following error:

Traceback (most recent call last):

```

File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
    estimator.fit(X_train, y_train, **fit_params)
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
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    estimator._validate_params()
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
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    validate_parameter_constraints(
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_samples'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.1497736826427634) instead.

```

```
5 fits failed with the following error:
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  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
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    validate_parameter_constraints(
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packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.3866803872980475) instead.
```

```
5 fits failed with the following error:
Traceback (most recent call last):
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
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  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
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packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.0393774484000624) instead.
```

```
5 fits failed with the following error:
Traceback (most recent call last):
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
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  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
```

```
packages/sklearn/base.py", line 1358, in wrapper
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    validate_parameter_constraints(
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validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_samples'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.0857755812734633) instead.
```

5 fits failed with the following error:

Traceback (most recent call last):

```
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
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  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.0733670416719332) instead.
```

5 fits failed with the following error:

Traceback (most recent call last):

```
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
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    validate_parameter_constraints(
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
```

```
raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_samples'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.4611905638239142) instead.
```

5 fits failed with the following error:

Traceback (most recent call last):

```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
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packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
```

```
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_samples'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.1557226353807422) instead.
```

5 fits failed with the following error:

Traceback (most recent call last):

```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
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```

```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
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packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
```

```
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.4366481518557073) instead.
```

5 fits failed with the following error:

Traceback (most recent call last):

```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
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File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
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    estimator._validate_params()
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packages/sklearn/base.py", line 471, in _validate_params
    validate_parameter_constraints(
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_samples'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.2506147516408583) instead.
```

5 fits failed with the following error:

Traceback (most recent call last):

```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
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packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_samples'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.1798447799002458) instead.
```

5 fits failed with the following error:

Traceback (most recent call last):

```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
    estimator.fit(X_train, y_train, **fit_params)
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
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```

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sklearn.utils._param_validation.InvalidParameterError: The 'max_samples'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.0343274735305634) instead.

```

5 fits failed with the following error:

Traceback (most recent call last):

```

File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
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packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.3955232284962005) instead.

```

5 fits failed with the following error:

Traceback (most recent call last):

```

File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
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File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
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packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_samples'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.4568008851264564) instead.

```

```
5 fits failed with the following error:
Traceback (most recent call last):
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
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packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.4461945428816902) instead.
```

```
5 fits failed with the following error:
Traceback (most recent call last):
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
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packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.4742482085344102) instead.
```

```
5 fits failed with the following error:
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  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
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```

```
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    estimator._validate_params()
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    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.2058314838786945) instead.
```

5 fits failed with the following error:

Traceback (most recent call last):

```
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
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sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.3668687053108415) instead.
```

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```
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
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validate_parameter_constraints
```



```
raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_samples'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.3918969087767765) instead.
```

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```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
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```

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```
sklearn.utils._param_validation.InvalidParameterError: The 'max_samples'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.0813054172267824) instead.
```

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Traceback (most recent call last):

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```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
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```

```
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```
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parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.4472485773838586) instead.
```

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```

File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
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File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 1358, in wrapper
    estimator._validate_params()
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 471, in _validate_params
    validate_parameter_constraints(
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.058404249735805) instead.

```

5 fits failed with the following error:

Traceback (most recent call last):

```

File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
    estimator.fit(X_train, y_train, **fit_params)
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 1358, in wrapper
    estimator._validate_params()
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 471, in _validate_params
    validate_parameter_constraints(
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_samples'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.1492103021160636) instead.

```

5 fits failed with the following error:

Traceback (most recent call last):

```

File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
    estimator.fit(X_train, y_train, **fit_params)
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 1358, in wrapper
    estimator._validate_params()
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 471, in _validate_params

```

```
    validate_parameter_constraints(
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_samples'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.0283701212972092) instead.
```

5 fits failed with the following error:

Traceback (most recent call last):

```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
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File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
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File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 471, in _validate_params
    validate_parameter_constraints(
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.4779006687542708) instead.
```

5 fits failed with the following error:

Traceback (most recent call last):

```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
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File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
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File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 471, in _validate_params
    validate_parameter_constraints(
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.4191157152786595) instead.
```

```
5 fits failed with the following error:
Traceback (most recent call last):
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
    estimator.fit(X_train, y_train, **fit_params)
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
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    estimator._validate_params()
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 471, in _validate_params
    validate_parameter_constraints(
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.401158010490989) instead.
```

```
5 fits failed with the following error:
Traceback (most recent call last):
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
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packages/sklearn/base.py", line 471, in _validate_params
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packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.4743948076661666) instead.
```

```
5 fits failed with the following error:
Traceback (most recent call last):
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
    estimator.fit(X_train, y_train, **fit_params)
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
```

```
packages/sklearn/base.py", line 1358, in wrapper
    estimator._validate_params()
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packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.1847311725538794) instead.
```

5 fits failed with the following error:

Traceback (most recent call last):

```
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
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validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.449799913291924) instead.
```

5 fits failed with the following error:

Traceback (most recent call last):

```
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
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packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
```

```
raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.4327284833540133) instead.
```

5 fits failed with the following error:

Traceback (most recent call last):

```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
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packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
```

```
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.2776022837352254) instead.
```

```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
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```
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.2776022837352254) instead.
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```
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parameter of BaggingClassifier must be an int in the range [1, inf) or a float
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packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
```

```
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.3383287047111379) instead.
```

```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
```

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sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
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```

```
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.3383287047111379) instead.
```

```
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
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```

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```

File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
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File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 471, in _validate_params
    validate_parameter_constraints(
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_samples'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.1917143971689121) instead.

```

5 fits failed with the following error:

Traceback (most recent call last):

```

File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
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File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
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packages/sklearn/utils/_param_validation.py", line 98, in
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    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.4131657522576428) instead.

```

5 fits failed with the following error:

Traceback (most recent call last):

```

File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
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```

```
    validate_parameter_constraints(
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packages/sklearn/utils/_param_validation.py", line 98, in
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    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.10617463445088) instead.
```

5 fits failed with the following error:

Traceback (most recent call last):

```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
    estimator.fit(X_train, y_train, **fit_params)
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
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File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
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    validate_parameter_constraints(
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.3521815003185402) instead.
```

5 fits failed with the following error:

Traceback (most recent call last):

```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
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    estimator.fit(X_train, y_train, **fit_params)
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File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
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packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.2040797680992235) instead.
```

```
5 fits failed with the following error:
Traceback (most recent call last):
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
    estimator.fit(X_train, y_train, **fit_params)
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
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    estimator._validate_params()
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
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    validate_parameter_constraints(
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packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.108087849541885) instead.
```

```
5 fits failed with the following error:
Traceback (most recent call last):
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
    estimator.fit(X_train, y_train, **fit_params)
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  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 471, in _validate_params
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packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_samples'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.013989489159811) instead.
```

```
5 fits failed with the following error:
Traceback (most recent call last):
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
    estimator.fit(X_train, y_train, **fit_params)
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
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```
packages/sklearn/base.py", line 1358, in wrapper
    estimator._validate_params()
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    validate_parameter_constraints(
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packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.362363708746745) instead.
```

5 fits failed with the following error:

Traceback (most recent call last):

```
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
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  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
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validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_samples'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.1334008543167258) instead.
```

5 fits failed with the following error:

Traceback (most recent call last):

```
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
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```

```
raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.1408747448032146) instead.
```

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```
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parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.0152360548642108) instead.
```

```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
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```
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.0344235037325231) instead.
```

```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
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validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.0116570135472611) instead.
```

5 fits failed with the following error:

Traceback (most recent call last):

```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
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File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
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    estimator._validate_params()
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validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.3062012797930613) instead.
```

5 fits failed with the following error:

Traceback (most recent call last):

```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
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validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.2474709381337565) instead.
```

5 fits failed with the following error:

Traceback (most recent call last):

```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
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validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.3952068376871993) instead.
```

5 fits failed with the following error:

Traceback (most recent call last):

```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
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packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_samples'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.032617266455023) instead.
```

```
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  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
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validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_samples'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.0639650920188364) instead.
```

```
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sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.1488228402915759) instead.
```

```
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Traceback (most recent call last):
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```
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    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.0577422659504374) instead.
```

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```
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validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_samples'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.3996473971450123) instead.
```

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```
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
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```
raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_samples'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.4336918237598746) instead.
```

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validate_parameter_constraints
    raise InvalidParameterError(
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```
sklearn.utils._param_validation.InvalidParameterError: The 'max_samples'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.0245113895702547) instead.
```

```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
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```

```
sklearn.utils._param_validation.InvalidParameterError: The 'max_samples'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.4694704332753687) instead.
```

```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
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    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_samples'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.2228960966217757) instead.

```

5 fits failed with the following error:

Traceback (most recent call last):

```

File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
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validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.0350367320449105) instead.

```

5 fits failed with the following error:

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```

File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
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```

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sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.4679940665042341) instead.

```

5 fits failed with the following error:

Traceback (most recent call last):

```

File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
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parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.0298400231811167) instead.

```

5 fits failed with the following error:

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```

File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
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packages/sklearn/base.py", line 1358, in wrapper
    estimator._validate_params()
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 471, in _validate_params
    validate_parameter_constraints(
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.006103956359347) instead.

```

```
5 fits failed with the following error:
Traceback (most recent call last):
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
    estimator.fit(X_train, y_train, **fit_params)
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 1358, in wrapper
    estimator._validate_params()
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 471, in _validate_params
    validate_parameter_constraints(
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_samples'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.1845715478798333) instead.
```

```
5 fits failed with the following error:
Traceback (most recent call last):
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
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validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.2602278598896866) instead.
```

```
5 fits failed with the following error:
Traceback (most recent call last):
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
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  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
```

```
packages/sklearn/base.py", line 1358, in wrapper
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    validate_parameter_constraints(
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.3507274600164547) instead.
```

5 fits failed with the following error:

Traceback (most recent call last):

```
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
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validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.4383404568210378) instead.
```

5 fits failed with the following error:

Traceback (most recent call last):

```
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
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    validate_parameter_constraints(
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
```

```
raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.3279408871774918) instead.
```

5 fits failed with the following error:

Traceback (most recent call last):

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File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
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validate_parameter_constraints
    raise InvalidParameterError(
```

```
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.314574720231382) instead.
```

```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
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```
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.314574720231382) instead.
```

```
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
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packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
```

```
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.0883066757950566) instead.
```

```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
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parameter of BaggingClassifier must be an int in the range [1, inf) or a float
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```
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parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.0883066757950566) instead.
```

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sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
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File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
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    estimator._validate_params()
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 471, in _validate_params
    validate_parameter_constraints(
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packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.3996674452921731) instead.
```

5 fits failed with the following error:

Traceback (most recent call last):

```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
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File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
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    estimator._validate_params()
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    validate_parameter_constraints(
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packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_samples'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.3995745732745686) instead.
```

5 fits failed with the following error:

Traceback (most recent call last):

```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
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packages/sklearn/base.py", line 471, in _validate_params
```

```

        validate_parameter_constraints(
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_samples'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.439832123613475) instead.

```

5 fits failed with the following error:

Traceback (most recent call last):

```

File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
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File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
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    estimator._validate_params()
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packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_samples'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.2940251892702959) instead.

```

5 fits failed with the following error:

Traceback (most recent call last):

```

File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
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File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
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File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 471, in _validate_params
    validate_parameter_constraints(
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.0731508492573887) instead.

```

```
5 fits failed with the following error:
Traceback (most recent call last):
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
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  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
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    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_samples'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.0698896848713164) instead.
```

```
5 fits failed with the following error:
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packages/sklearn/utils/_param_validation.py", line 98, in
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    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_samples'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.3212573046720129) instead.
```

```
5 fits failed with the following error:
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  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
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```
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packages/sklearn/base.py", line 471, in _validate_params
    validate_parameter_constraints(
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packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_samples'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.271881980598245) instead.
```

5 fits failed with the following error:

Traceback (most recent call last):

```
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
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packages/sklearn/base.py", line 471, in _validate_params
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packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.0427244433475962) instead.
```

5 fits failed with the following error:

Traceback (most recent call last):

```
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
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    estimator.fit(X_train, y_train, **fit_params)
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
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packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
```

```
raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.1149502631526544) instead.
```

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Traceback (most recent call last):

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File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
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validate_parameter_constraints
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```
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sklearn.utils._param_validation.InvalidParameterError: The 'max_samples'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.3721239089441515) instead.
```

5 fits failed with the following error:

Traceback (most recent call last):

```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
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```

```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
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```
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sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.4224993811772957) instead.
```

5 fits failed with the following error:

Traceback (most recent call last):

```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
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    estimator.fit(X_train, y_train, **fit_params)
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 1358, in wrapper
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File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 471, in _validate_params
    validate_parameter_constraints(
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
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sklearn.utils._param_validation.InvalidParameterError: The 'max_samples'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.236444235624723) instead.
```

5 fits failed with the following error:

Traceback (most recent call last):

```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
    estimator.fit(X_train, y_train, **fit_params)
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 1358, in wrapper
    estimator._validate_params()
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 471, in _validate_params
    validate_parameter_constraints(
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.3698963620621283) instead.
```

5 fits failed with the following error:

Traceback (most recent call last):

```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
    estimator.fit(X_train, y_train, **fit_params)
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 1358, in wrapper
    estimator._validate_params()
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 471, in _validate_params
```

```

    validate_parameter_constraints(
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.2442496518432888) instead.

```

5 fits failed with the following error:

Traceback (most recent call last):

```

File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
    estimator.fit(X_train, y_train, **fit_params)
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 1358, in wrapper
    estimator._validate_params()
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 471, in _validate_params
    validate_parameter_constraints(
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.4127494628791288) instead.

```

5 fits failed with the following error:

Traceback (most recent call last):

```

File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
    estimator.fit(X_train, y_train, **fit_params)
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 1358, in wrapper
    estimator._validate_params()
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 471, in _validate_params
    validate_parameter_constraints(
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.1635373720167106) instead.

```

```
5 fits failed with the following error:
Traceback (most recent call last):
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
    estimator.fit(X_train, y_train, **fit_params)
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 1358, in wrapper
    estimator._validate_params()
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 471, in _validate_params
    validate_parameter_constraints(
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.0021950103312425) instead.
```

```
5 fits failed with the following error:
Traceback (most recent call last):
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
    estimator.fit(X_train, y_train, **fit_params)
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 1358, in wrapper
    estimator._validate_params()
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 471, in _validate_params
    validate_parameter_constraints(
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.2140591997898282) instead.
```

```
5 fits failed with the following error:
Traceback (most recent call last):
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
    estimator.fit(X_train, y_train, **fit_params)
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
```

```
packages/sklearn/base.py", line 1358, in wrapper
    estimator._validate_params()
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 471, in _validate_params
    validate_parameter_constraints(
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_samples'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.3617856210135173) instead.
```

5 fits failed with the following error:

Traceback (most recent call last):

```
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
    estimator.fit(X_train, y_train, **fit_params)
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 1358, in wrapper
    estimator._validate_params()
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
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    validate_parameter_constraints(
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.3974304098188841) instead.
```

5 fits failed with the following error:

Traceback (most recent call last):

```
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
    estimator.fit(X_train, y_train, **fit_params)
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 1358, in wrapper
    estimator._validate_params()
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 471, in _validate_params
    validate_parameter_constraints(
  File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
```

```
raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.3669937600115234) instead.
```

5 fits failed with the following error:

Traceback (most recent call last):

```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
    estimator.fit(X_train, y_train, **fit_params)
```

```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 1358, in wrapper
    estimator._validate_params()
```

```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 471, in _validate_params
    validate_parameter_constraints(
```

```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
```

```
sklearn.utils._param_validation.InvalidParameterError: The 'max_samples'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.2999160853731895) instead.
```

```
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.2999160853731895) instead.
```

5 fits failed with the following error:

Traceback (most recent call last):

```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
    estimator.fit(X_train, y_train, **fit_params)
```

```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 1358, in wrapper
    estimator._validate_params()
```

```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 471, in _validate_params
    validate_parameter_constraints(
```

```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
```

```
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.2208130963105066) instead.
```

```
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.2208130963105066) instead.
```

5 fits failed with the following error:

Traceback (most recent call last):

```

File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
    estimator.fit(X_train, y_train, **fit_params)
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 1358, in wrapper
    estimator._validate_params()
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 471, in _validate_params
    validate_parameter_constraints(
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.3302198645669916) instead.

```

5 fits failed with the following error:

Traceback (most recent call last):

```

File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
    estimator.fit(X_train, y_train, **fit_params)
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 1358, in wrapper
    estimator._validate_params()
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 471, in _validate_params
    validate_parameter_constraints(
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_samples'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.3963358185211199) instead.

```

5 fits failed with the following error:

Traceback (most recent call last):

```

File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
    estimator.fit(X_train, y_train, **fit_params)
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 1358, in wrapper
    estimator._validate_params()
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 471, in _validate_params

```



```
    validate_parameter_constraints(
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.3926717110769748) instead.
```

5 fits failed with the following error:

Traceback (most recent call last):

```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
    estimator.fit(X_train, y_train, **fit_params)
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 1358, in wrapper
    estimator._validate_params()
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 471, in _validate_params
    validate_parameter_constraints(
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.0902949425148076) instead.
```

5 fits failed with the following error:

Traceback (most recent call last):

```
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
    estimator.fit(X_train, y_train, **fit_params)
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 1358, in wrapper
    estimator._validate_params()
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/base.py", line 471, in _validate_params
    validate_parameter_constraints(
File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/utils/_param_validation.py", line 98, in
validate_parameter_constraints
    raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.3684679758979128) instead.
```

5 fits failed with the following error:

Traceback (most recent call last):

File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-packages/sklearn/model_selection/_validation.py", line 859, in _fit_and_score
estimator.fit(X_train, y_train, **fit_params)

File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-packages/sklearn/base.py", line 1358, in wrapper
estimator._validate_params()

File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-packages/sklearn/base.py", line 471, in _validate_params
validate_parameter_constraints(

File "/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-packages/sklearn/utils/_param_validation.py", line 98, in validate_parameter_constraints

raise InvalidParameterError(
sklearn.utils._param_validation.InvalidParameterError: The 'max_samples'
parameter of BaggingClassifier must be an int in the range [1, inf) or a float
in the range (0.0, 1.0]. Got np.float64(1.1450541677693296) instead.

warnings.warn(some_fits_failed_message, FitFailedWarning)
/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-packages/sklearn/model_selection/_search.py:1135: UserWarning: One or more of
the test scores are non-finite: [
nan nan 0.88635 nan nan
nan nan 0.87913 nan nan 0.76758 nan
nan 0.84756 nan nan nan nan nan
0.88604 nan nan nan nan nan nan
nan
nan nan nan nan 0.81328 0.87733 nan
nan nan 0.89116 nan nan nan nan
0.88604 0.86921 0.87251 nan nan nan 0.88545
0.72309 nan nan nan nan 0.72309 nan
nan nan nan 0.88875 nan 0.88875 nan
nan nan 0.86981 nan nan nan nan
0.88605 0.87943 0.88394 nan nan nan 0.87432
0.88484 nan nan nan nan nan nan
nan 0.87522 nan 0.87853 nan nan
0.89086 nan nan nan nan nan 0.87101 nan
nan nan nan nan nan nan nan
0.84696 nan nan nan nan nan 0.87402
nan 0.87973 0.88845 nan nan nan
nan nan nan nan nan 0.86951 nan
0.74533 nan 0.86921 nan nan nan nan
0.87823 nan 0.87312 nan nan 0.89055
nan 0.88334 nan nan 0.88454 nan
nan nan nan 0.88364 nan nan nan
nan 0.82892 nan nan nan nan nan

```

nan          nan      0.76758          nan          nan          nan
          nan          nan          nan          nan          nan          nan
nan          nan          nan          nan          nan      0.78983          nan
nan      0.87251          nan          nan          nan          nan      0.87733
nan          nan      0.88665      0.83673          nan      0.88304
          nan          nan      0.88184          nan          nan          nan
nan          nan          nan          nan          nan      0.84515          nan
nan      0.83463          nan      0.88063          nan]
warnings.warn(

```

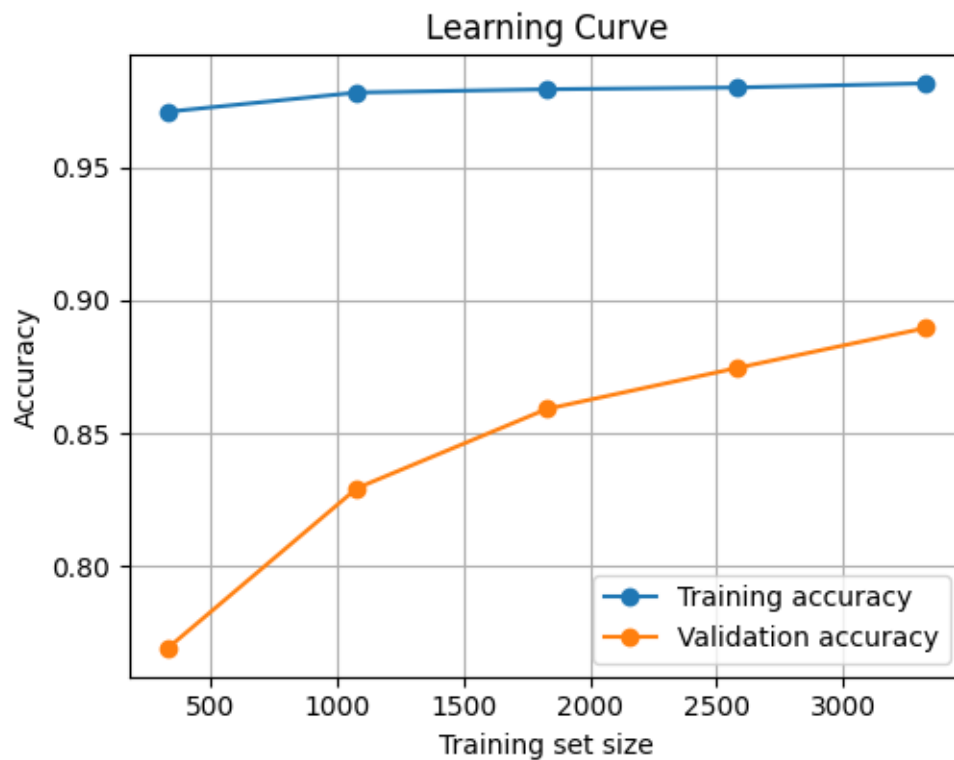
Random Search Results:

Best parameters found: {'bootstrap_features': False, 'estimator_max_depth': 23, 'estimator_min_samples_split': 5, 'max_features': np.float64(0.5808533263327152), 'max_samples': np.float64(0.8696544560614045), 'n_estimators': 354}

Best mean cross-validation accuracy: 0.8911558174716069

-----FIRST

ANALYSIS-----

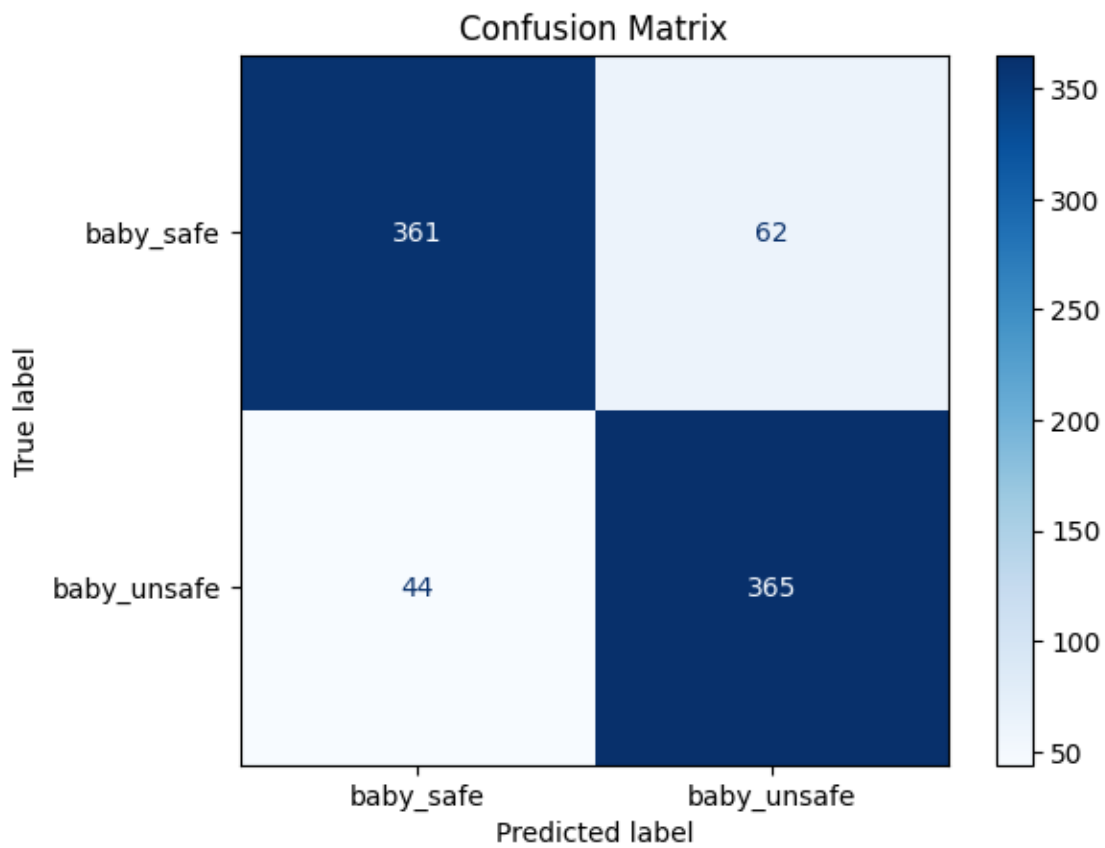


Dataset labels:-----
{'baby_safe': 0, 'baby_unsafe': 1}

Report-----

	precision	recall	f1-score	support
baby_safe	0.89	0.85	0.87	423
baby_unsafe	0.85	0.89	0.87	409
accuracy			0.87	832
macro avg	0.87	0.87	0.87	832
weighted avg	0.87	0.87	0.87	832

Confusion matrix-----



6 6) Ensemble

```
[17]: voting_clf_soft = VotingClassifier(
      estimators=[('lr', lr_2), ('rf', random_forest_2), ('xgb', xgbc_2),
      ↪ ('bagging', bagging_2)],
      voting='soft' # 'hard' per la maggioranza, 'soft' per le probabilità
    )

results_voting_soft = clf.
      ↪ evaluation_pipeline(voting_clf_soft, verbose=True, is_ensemble=True)
```

-----FIRST

ANALYSIS-----

/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/svm/_base.py:1250: ConvergenceWarning: Liblinear failed to
converge, increase the number of iterations.

warnings.warn(

/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/svm/_base.py:1250: ConvergenceWarning: Liblinear failed to
converge, increase the number of iterations.

warnings.warn(

/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/svm/_base.py:1250: ConvergenceWarning: Liblinear failed to
converge, increase the number of iterations.

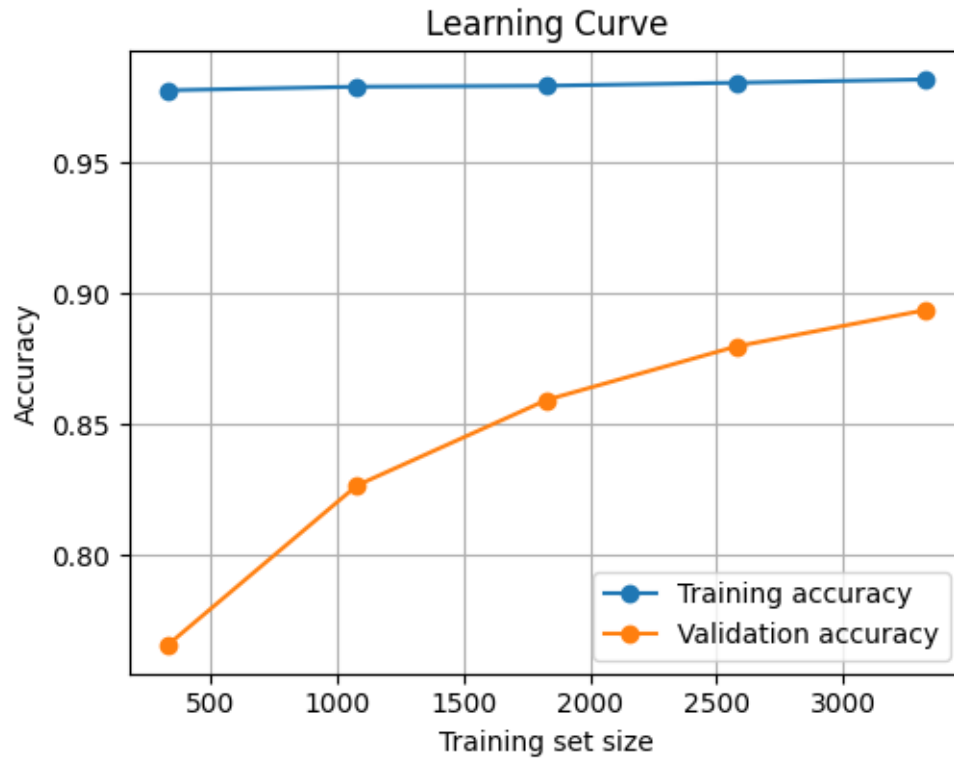
warnings.warn(

/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/svm/_base.py:1250: ConvergenceWarning: Liblinear failed to
converge, increase the number of iterations.

warnings.warn(

/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/svm/_base.py:1250: ConvergenceWarning: Liblinear failed to
converge, increase the number of iterations.

warnings.warn(



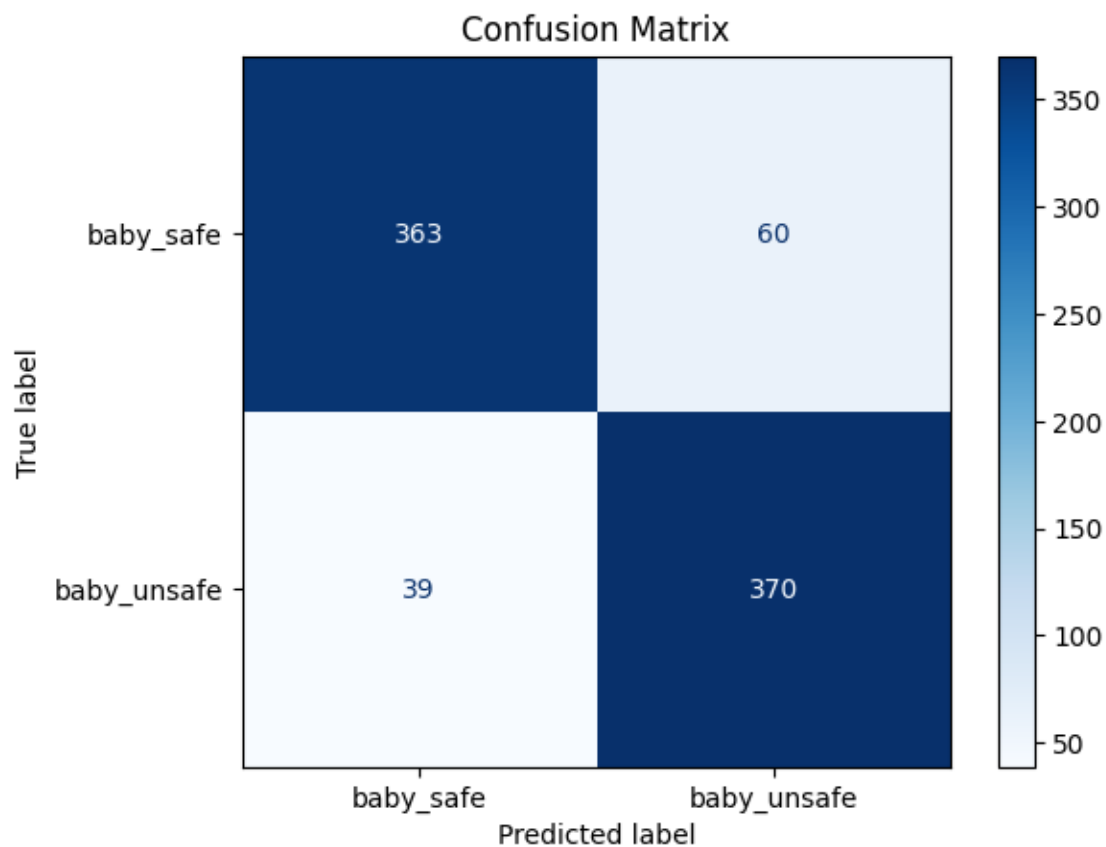
Dataset labels:-----

```
{'baby_safe': 0, 'baby_unsafe': 1}
```

Report-----

	precision	recall	f1-score	support
baby_safe	0.90	0.86	0.88	423
baby_unsafe	0.86	0.90	0.88	409
accuracy			0.88	832
macro avg	0.88	0.88	0.88	832
weighted avg	0.88	0.88	0.88	832

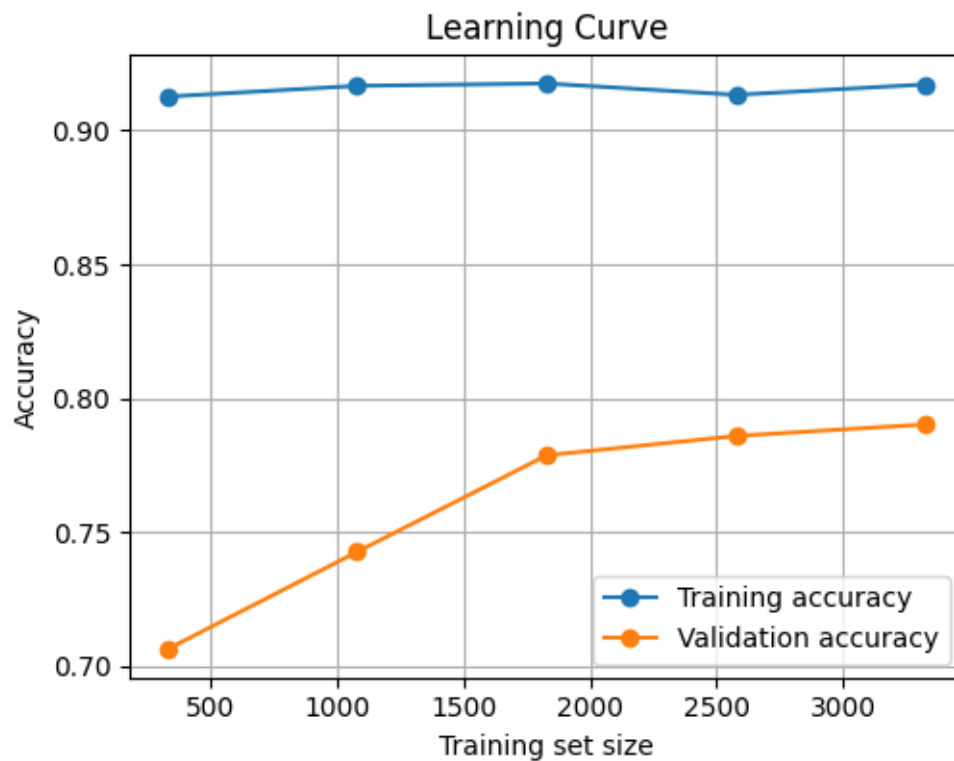
Confusion matrix-----



```
[18]: top_10_features_idx = results_lr_2['top_10_features']['top_features_idx']

results_voting_soft = clf.ensemble_on_top_features(
    ensemble_clf=voting_clf_soft,
    top_features_idx=top_10_features_idx,
    verbose=True
)
```

```
-----
-----
-----ENSEMBLE MODEL EVALUATION ON TOP 10
FEATURES-----
-----
-----
```



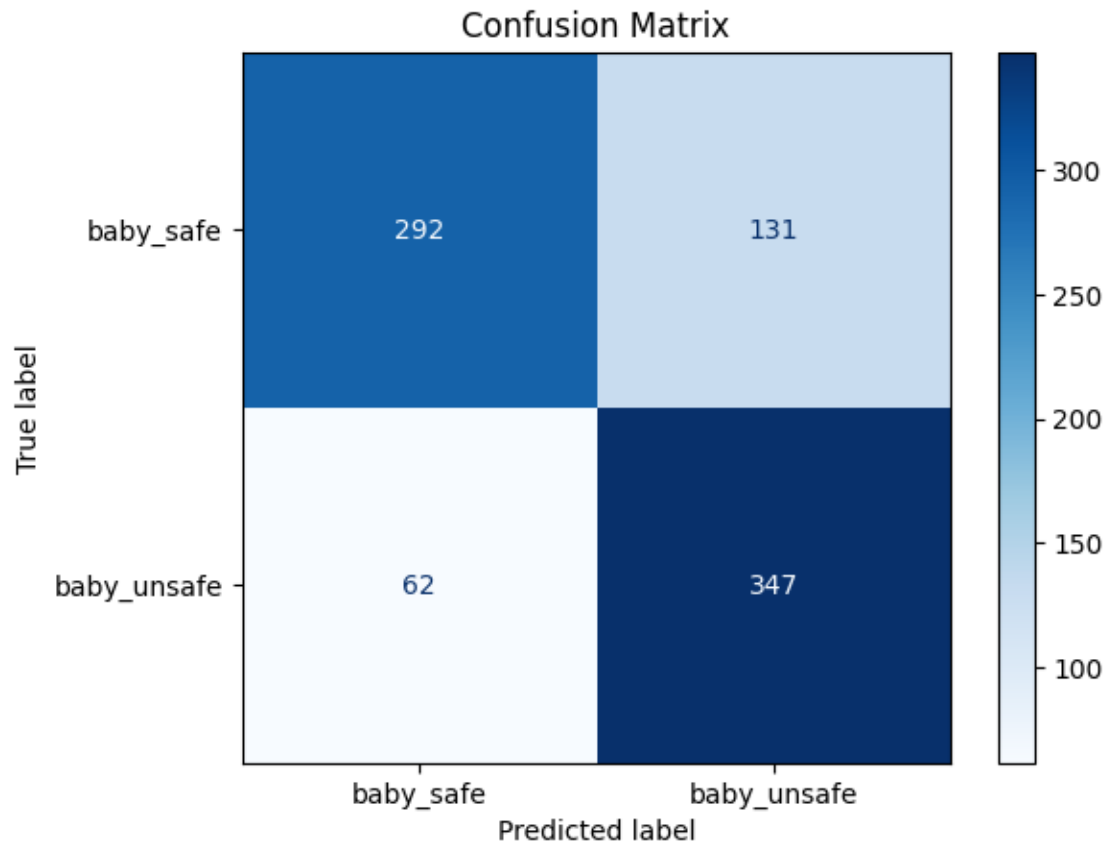
Dataset labels:-----

`{'baby_safe': 0, 'baby_unsafe': 1}`

Report-----

	precision	recall	f1-score	support
baby_safe	0.82	0.69	0.75	423
baby_unsafe	0.73	0.85	0.78	409
accuracy			0.77	832
macro avg	0.78	0.77	0.77	832
weighted avg	0.78	0.77	0.77	832

Confusion matrix-----

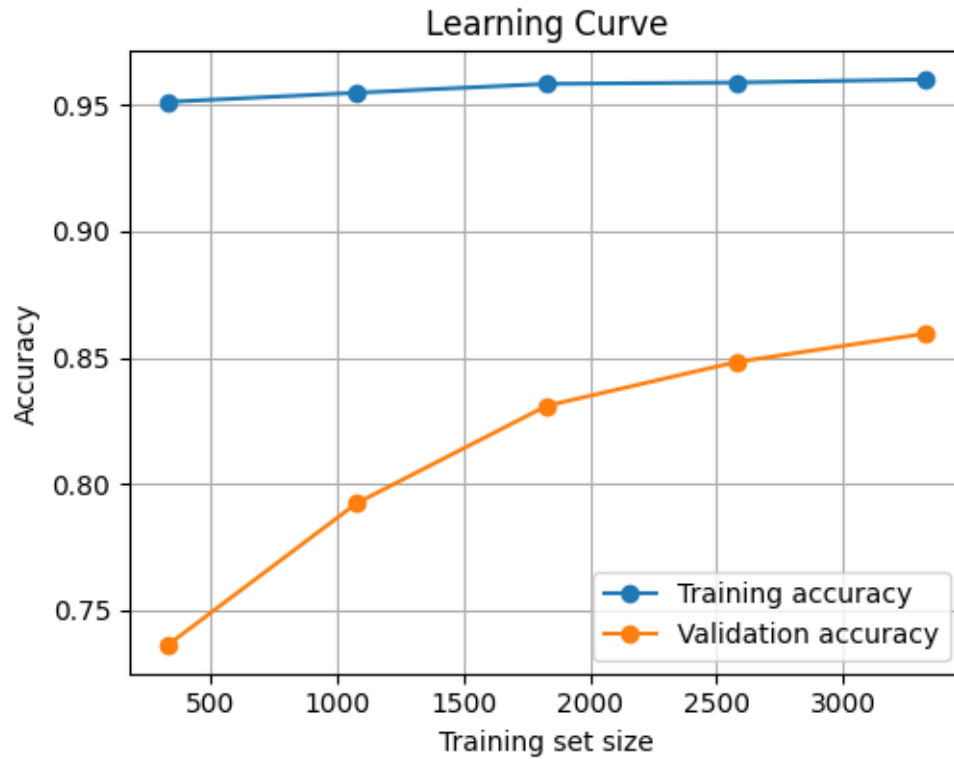


```
[20]: top_25_features_idx = results_lr_2['top_25_features']['top_features_idx']
```

```
results_voting_soft = clf.ensemble_on_top_features(
    ensemble_clf=voting_clf_soft,
    top_features_idx=top_25_features_idx,
    verbose=True
)
```

```
-----
-----
-----ENSEMBLE MODEL EVALUATION ON TOP 25
FEATURES-----
-----
```

```
/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/svm/_base.py:1250: ConvergenceWarning: Liblinear failed to
converge, increase the number of iterations.
warnings.warn(
```



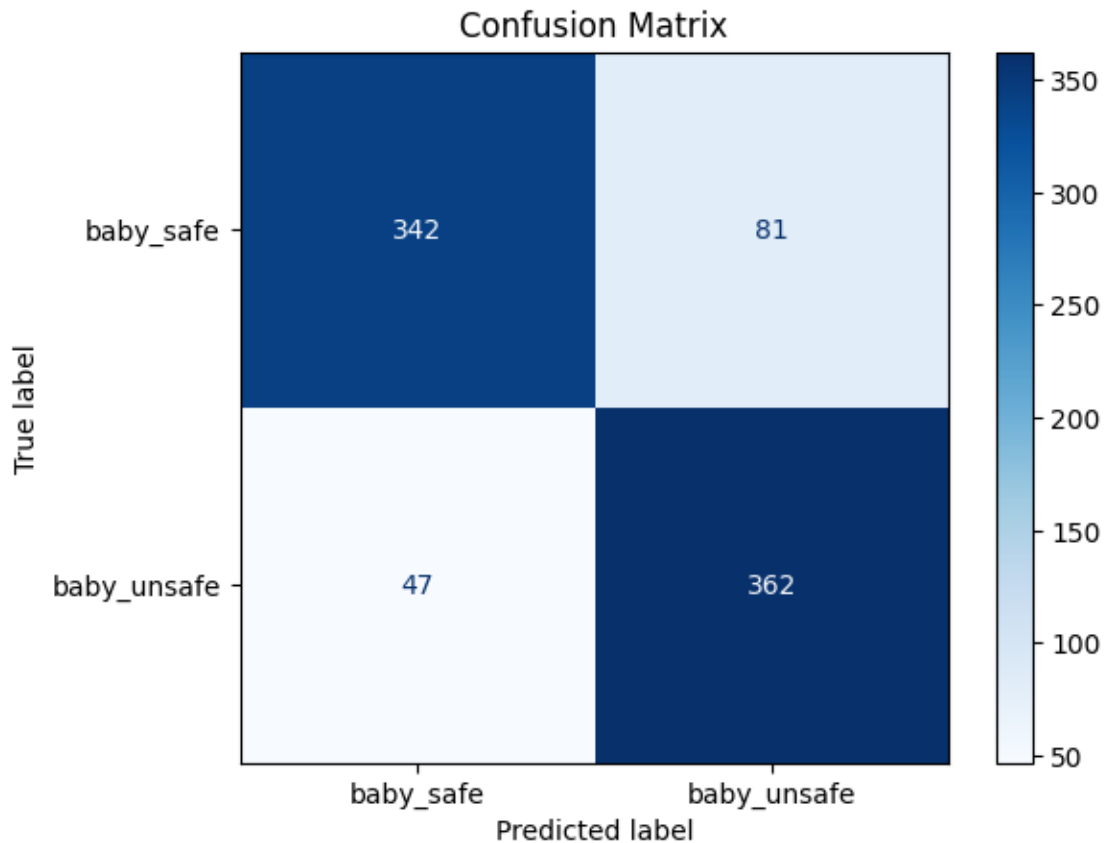
Dataset labels:-----

`{'baby_safe': 0, 'baby_unsafe': 1}`

Report-----

	precision	recall	f1-score	support
baby_safe	0.88	0.81	0.84	423
baby_unsafe	0.82	0.89	0.85	409
accuracy			0.85	832
macro avg	0.85	0.85	0.85	832
weighted avg	0.85	0.85	0.85	832

Confusion matrix-----



```
[21]: from sklearn.calibration import CalibratedClassifierCV
# Calibrazione dei modelli per migliorare le probabilità
# Per la Regressione Logistica, la calibrazione è solitamente meno necessaria,
#   ↳ ma è una buona pratica
calibrated_lr = CalibratedClassifierCV(lr_2, method='isotonic', cv=5)

# Per il Random Forest e altri modelli basati su alberi, la calibrazione è
#   ↳ molto utile
calibrated_rf = CalibratedClassifierCV(random_forest_2, method='isotonic', cv=5)

# Anche per XGBoost, la calibrazione può aiutare
calibrated_xgbc = CalibratedClassifierCV(xgbc_2, method='isotonic', cv=5)

calibrated_bagging = CalibratedClassifierCV(bagging_2, method='isotonic', cv=5)

# Creazione del VotingClassifier utilizzando i modelli calibrati
# Nota: La calibrazione richiede 'voting='soft' per funzionare correttamente
voting_clf_soft_calibrated = VotingClassifier(
    estimators=[
```

```

        ('lr_calibrated', calibrated_lr),
        ('rf_calibrated', calibrated_rf),
        ('xgbc_calibrated', calibrated_xgbc),
        ('bagging_calibrated', calibrated_bagging)
    ],
    voting='soft'
)
results_voting_soft_calibrated = clf.
evaluation_pipeline(voting_clf_soft, verbose=True, is_ensemble=True)

```

```

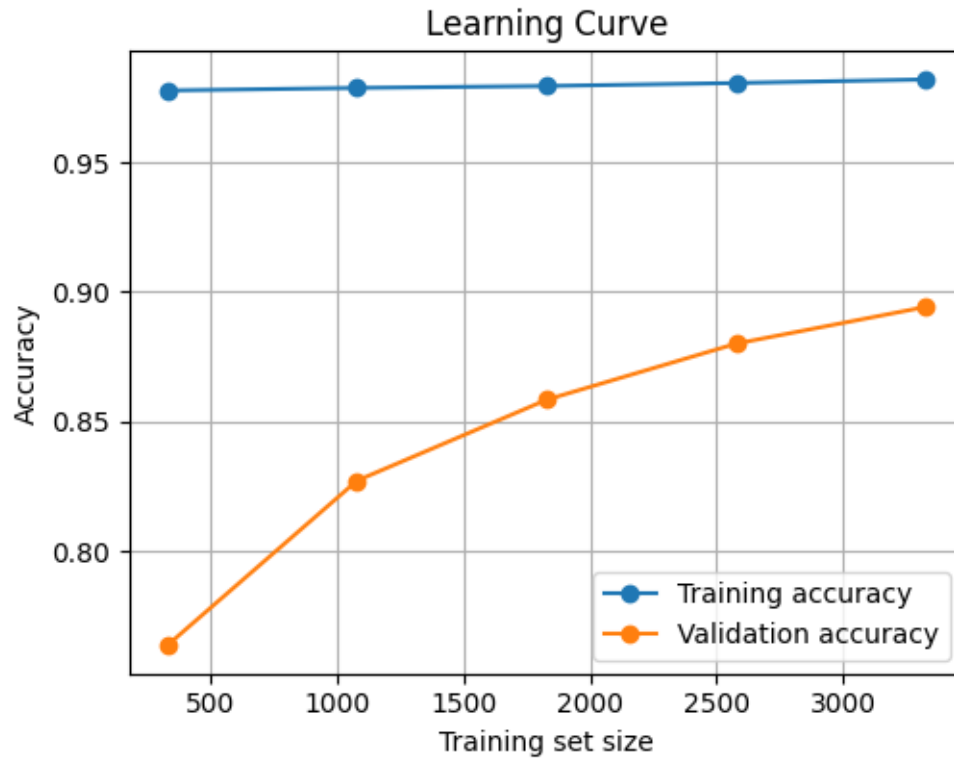
-----
-----
-----FIRST
ANALYSIS-----
-----

```

```

/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/svm/_base.py:1250: ConvergenceWarning: Liblinear failed to
converge, increase the number of iterations.
    warnings.warn(
/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/svm/_base.py:1250: ConvergenceWarning: Liblinear failed to
converge, increase the number of iterations.
    warnings.warn(
/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/svm/_base.py:1250: ConvergenceWarning: Liblinear failed to
converge, increase the number of iterations.
    warnings.warn(

```



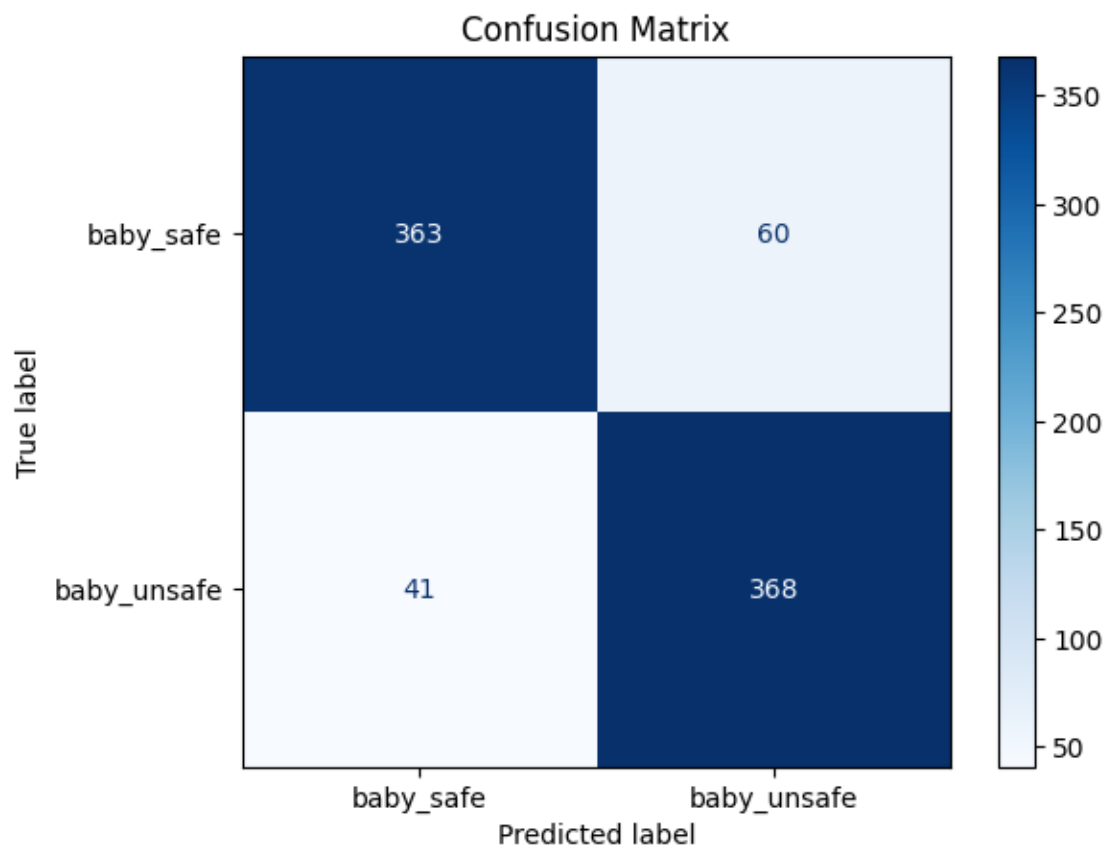
Dataset labels:-----

```
{'baby_safe': 0, 'baby_unsafe': 1}
```

Report-----

	precision	recall	f1-score	support
baby_safe	0.90	0.86	0.88	423
baby_unsafe	0.86	0.90	0.88	409
accuracy			0.88	832
macro avg	0.88	0.88	0.88	832
weighted avg	0.88	0.88	0.88	832

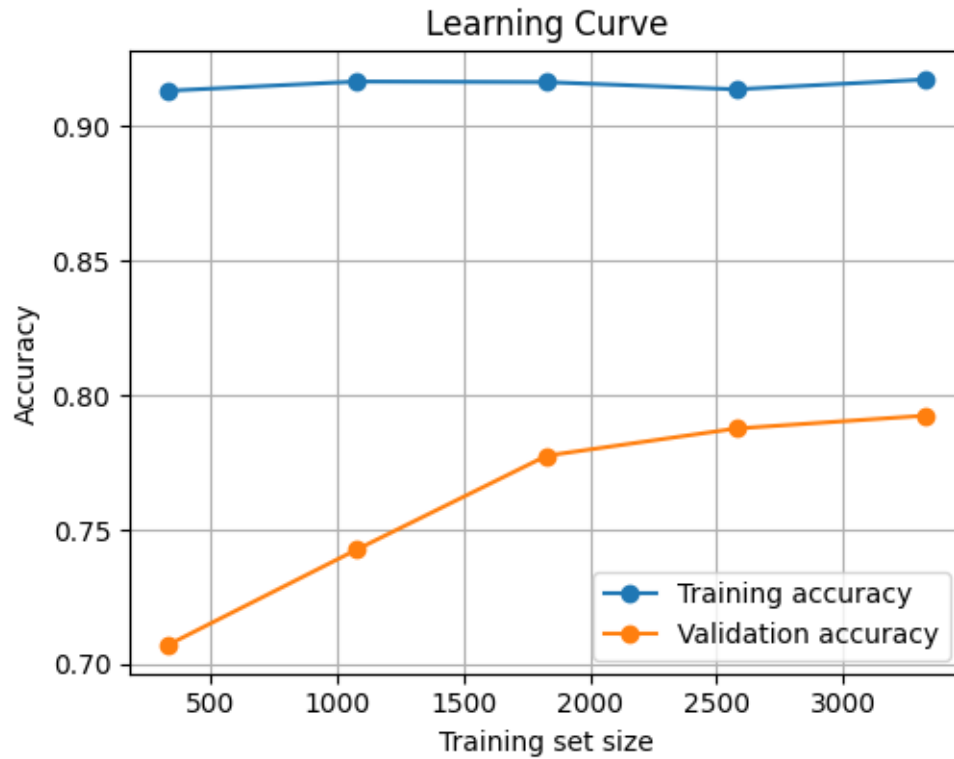
Confusion matrix-----



```
[22]: top_10_features_idx = results_lr_2['top_10_features']['top_features_idx']
```

```
clf.ensemble_on_top_features(
    ensemble_clf=voting_clf_soft,
    top_features_idx=top_10_features_idx,
    verbose=True
)
```

```
-----
-----
-----ENSEMBLE MODEL EVALUATION ON TOP 10
FEATURES-----
-----
-----
```



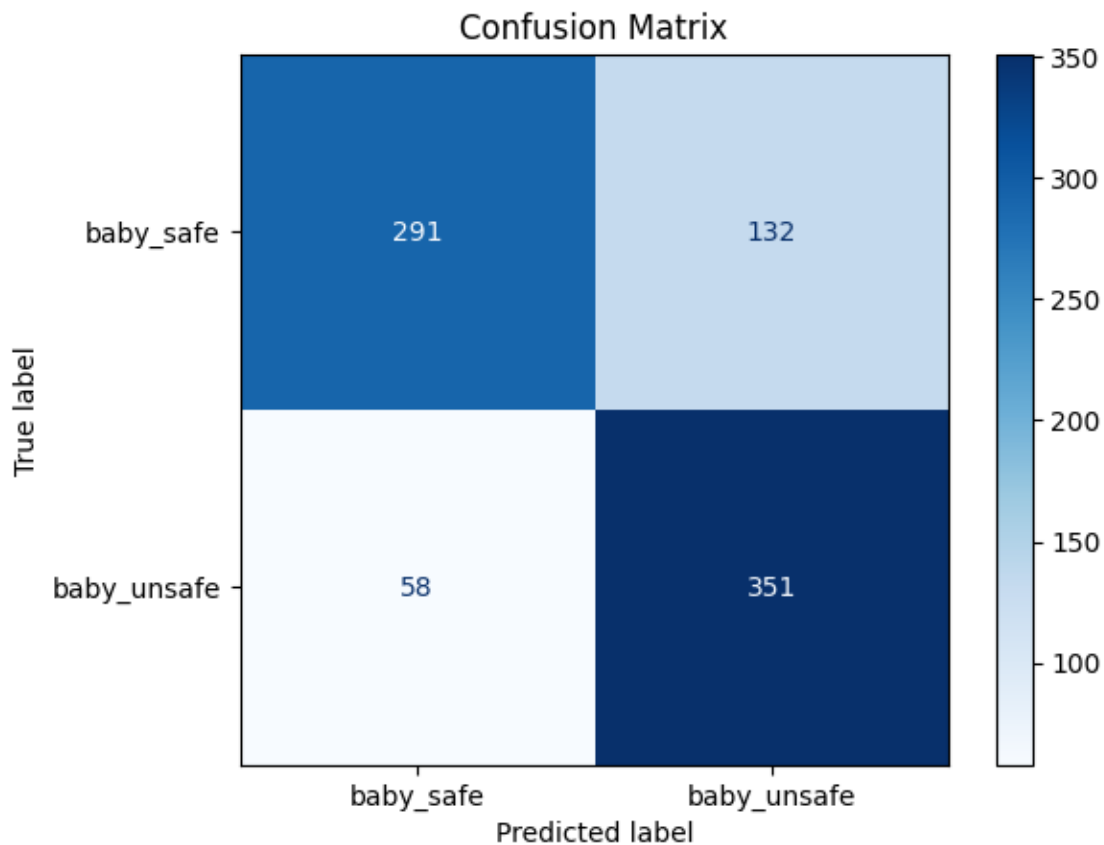
Dataset labels:-----

`{'baby_safe': 0, 'baby_unsafe': 1}`

Report-----

	precision	recall	f1-score	support
baby_safe	0.83	0.69	0.75	423
baby_unsafe	0.73	0.86	0.79	409
accuracy			0.77	832
macro avg	0.78	0.77	0.77	832
weighted avg	0.78	0.77	0.77	832

Confusion matrix-----



```
[22]: {'top_10_features': {'model': VotingClassifier(estimators=[('lr',
    LogisticRegression(C=np.float64(584.8333713948902),
                                                                penalty='l1',
                                                                solver='liblinear')),
    ('rf',
     RandomForestClassifier(bootstrap=False,
                            criterion='entropy',
                            max_depth=23,
                            max_features='log2',
                            min_samples_split=15,
                            n_estimators=570)),
    ('xgb',
     XGBClassifier(base_score=None, booster=None,
                   callbacks=None,
                   colsample_bylevel=None,
                   cols...
                   min_child_weight=None,
missing=nan,
                   monotone_constraints=None,
                   multi_strategy=None,
```



```

n_estimators=319, n_jobs=None,
num_parallel_tree=None, ...)),
('bagging',
BaggingClassifier(estimator=DecisionTreeClassifier(max_depth=23,
min_samples_split=5,
random_state=42),
max_features=np.float64(0.5808533263327152),
max_samples=np.float64(0.8696544560614045),
n_estimators=354))),
voting='soft'),
'X': array([[ 1.918, 1.8044, 1.4282, ..., 1.2842,
0.35158, 0.034592],
[ -0.55268, -0.5542, -0.64161, ..., -0.76013, 0.44207,
0.87255],
[ 1.7893, 1.8044, 1.5296, ..., 1.3254, 0.71313,
0.87339],
...,
[ -0.55268, -0.5542, -0.64161, ..., -0.76013, -2.7895,
0.28022],
[ -0.55268, -0.5542, -0.64161, ..., -0.76013, 0.5483,
-0.076905],
[ -0.55268, -0.5542, -0.64161, ..., -0.76013, 0.27976,
-0.013513]]),
'y': array([0, 1, 0, ..., 0, 0, 0]))}

```

```
[23]: top_25_features_idx = results_lr_2['top_25_features']['top_features_idx']
```

```

clf.ensemble_on_top_features(
    ensemble_clf=voting_clf_soft,
    top_features_idx=top_25_features_idx,
    verbose=True
)

```

```

-----
-----
-----ENSEMBLE MODEL EVALUATION ON TOP 25
FEATURES-----
-----

```

```

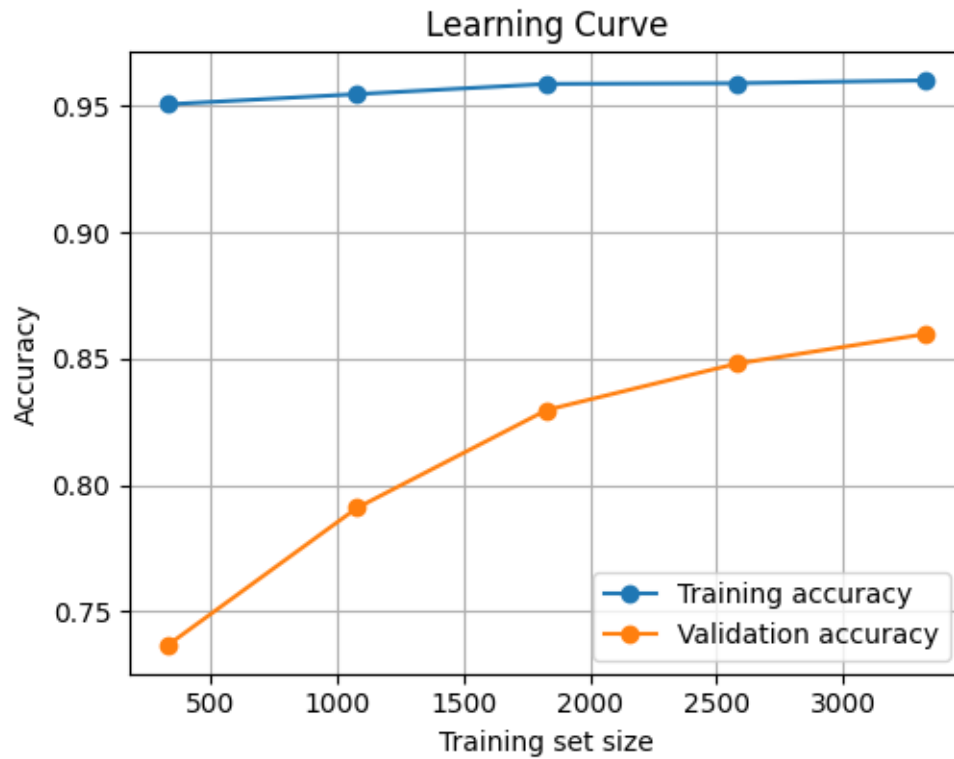
/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/svm/_base.py:1250: ConvergenceWarning: Liblinear failed to
converge, increase the number of iterations.
    warnings.warn(
/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/svm/_base.py:1250: ConvergenceWarning: Liblinear failed to
converge, increase the number of iterations.
    warnings.warn(

```

```

/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/svm/_base.py:1250: ConvergenceWarning: Liblinear failed to
converge, increase the number of iterations.
warnings.warn(

```

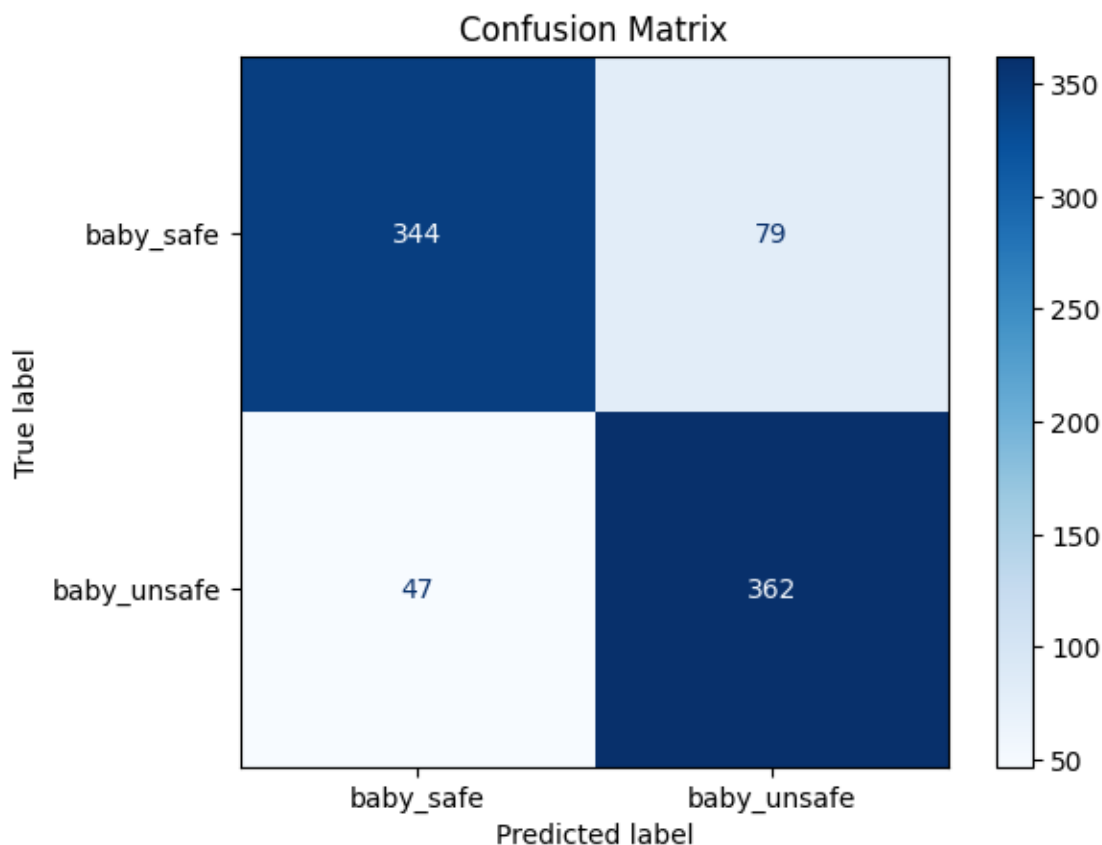


Dataset labels:-----
{'baby_safe': 0, 'baby_unsafe': 1}

Report-----

	precision	recall	f1-score	support
baby_safe	0.88	0.81	0.85	423
baby_unsafe	0.82	0.89	0.85	409
accuracy			0.85	832
macro avg	0.85	0.85	0.85	832
weighted avg	0.85	0.85	0.85	832

Confusion matrix-----



```
[23]: {'top_25_features': {'model': VotingClassifier(estimators=[('lr',
    LogisticRegression(C=np.float64(584.8333713948902),
                                                                penalty='l1',
                                                                solver='liblinear')),
    ('rf',
     RandomForestClassifier(bootstrap=False,
                            criterion='entropy',
                            max_depth=23,
                            max_features='log2',
                            min_samples_split=15,
                            n_estimators=570)),
    ('xgb',
     XGBClassifier(base_score=None, booster=None,
                  callbacks=None,
                  colsample_bylevel=None,
                  cols...
                  min_child_weight=None,
                  missing=nan,
                  monotone_constraints=None,
                  multi_strategy=None,
```

```

n_estimators=319, n_jobs=None,
num_parallel_tree=None, ...)),
('bagging',
BaggingClassifier(estimator=DecisionTreeClassifier(max_depth=23,
min_samples_split=5,
random_state=42),
max_features=np.float64(0.5808533263327152),
max_samples=np.float64(0.8696544560614045),
n_estimators=354))),
voting='soft'),
'X': array([[ 1.918, 1.8044, 1.4282, ..., -0.64366,
-1.128, 0.1228],
[ -0.55268, -0.5542, -0.64161, ..., 0.50425, -0.71912,
0.28633],
[ 1.7893, 1.8044, 1.5296, ..., -0.27022, -0.84831,
1.427],
...,
[ -0.55268, -0.5542, -0.64161, ..., 0.13744, 0.037326,
0.043654],
[ -0.55268, -0.5542, -0.64161, ..., 0.52552, 0.16036,
-0.25639],
[ -0.55268, -0.5542, -0.64161, ..., 0.027752, 1.2226,
0.43558]]),
'y': array([0, 1, 0, ..., 0, 0, 0]))}

```

7 Compare all the models

```

[24]: data_to_plot_1 = [
    (results_lr_1['all_features']['model'], "LR1 - All Features",
    results_lr_1['all_features']['X'], results_lr_1['all_features']['y']),
    (results_lr_2['all_features']['model'], "LR2 - All Features",
    results_lr_2['all_features']['X'], results_lr_2['all_features']['y']),
    (results_rf1['all_features']['model'], "RF1 - All Features",
    results_rf1['all_features']['X'], results_rf1['all_features']['y']),
    (results_rf2['all_features']['model'], "RF2 - All Features",
    results_rf2['all_features']['X'], results_rf2['all_features']['y']),
    (results_xgbc_1['all_features']['model'], "xgbc_1 - All Features",
    results_xgbc_1['all_features']['X'], results_xgbc_1['all_features']['y']),
    (results_xgbc_2['all_features']['model'], "xgbc_2 - All Features",
    results_xgbc_2['all_features']['X'], results_xgbc_2['all_features']['y']),
    (results_bagging_2['all_features']['model'], "Bagging - All Features",
    results_bagging_2['all_features']['X'],
    results_bagging_2['all_features']['y'])
]

data_to_plot_2 = [

```

```

        (results_lr_1['top_10_features']['model'], "LR1 - Top 10 features",
        ↪results_lr_1['top_10_features']['X'], results_lr_1['top_10_features']['y']),
        (results_lr_2['top_10_features']['model'], "LR2 - Top 10 features",
        ↪results_lr_2['top_10_features']['X'], results_lr_2['top_10_features']['y']),
        (results_rf1['top_10_features']['model'], "RF1 - Top 10 features",
        ↪results_rf1['top_10_features']['X'], results_rf1['top_10_features']['y']),
        (results_rf2['top_10_features']['model'], "RF2 - Top 10 features",
        ↪results_rf2['top_10_features']['X'], results_rf2['top_10_features']['y']),
        (results_xgbc_1['top_10_features']['model'], "xgbc_1 - Top 10
        ↪features", results_xgbc_1['top_10_features']['X'],
        ↪results_xgbc_1['top_10_features']['y']),
        (results_xgbc_2['top_10_features']['model'], "xgbc_2 - Top 10
        ↪features", results_xgbc_2['top_10_features']['X'],
        ↪results_xgbc_2['top_10_features']['y'])
    ]

data_to_plot_3 = [
    (results_lr_1['top_25_features']['model'], "LR1 - Top 25 features",
    ↪results_lr_1['top_25_features']['X'], results_lr_1['top_25_features']['y']),
    (results_lr_2['top_25_features']['model'], "LR2 - Top 25 features",
    ↪results_lr_2['top_25_features']['X'], results_lr_2['top_25_features']['y']),
    (results_rf1['top_25_features']['model'], "RF1 - Top 25 features",
    ↪results_rf1['top_25_features']['X'], results_rf1['top_25_features']['y']),
    (results_rf2['top_25_features']['model'], "RF2 - Top 25 features",
    ↪results_rf2['top_25_features']['X'], results_rf2['top_25_features']['y']),
    (results_xgbc_1['top_25_features']['model'], "xgbc_1 - Top 25
    ↪features", results_xgbc_1['top_25_features']['X'],
    ↪results_xgbc_1['top_25_features']['y']),
    (results_xgbc_2['top_25_features']['model'], "xgbc_2 - Top 25
    ↪features", results_xgbc_2['top_25_features']['X'],
    ↪results_xgbc_2['top_25_features']['y'])
]

clf.plot_learning_curve_comparison(data_sets=data_to_plot_1, title="Comparison
    ↪of all Learning Curves (all features)"
)
clf.plot_learning_curve_comparison(data_sets=data_to_plot_2, title="Comparison
    ↪of all Learning Curves (top_10_features)"
)
clf.plot_learning_curve_comparison(data_sets=data_to_plot_3, title="Comparison
    ↪of all Learning Curves (top_25_features)"
)

```

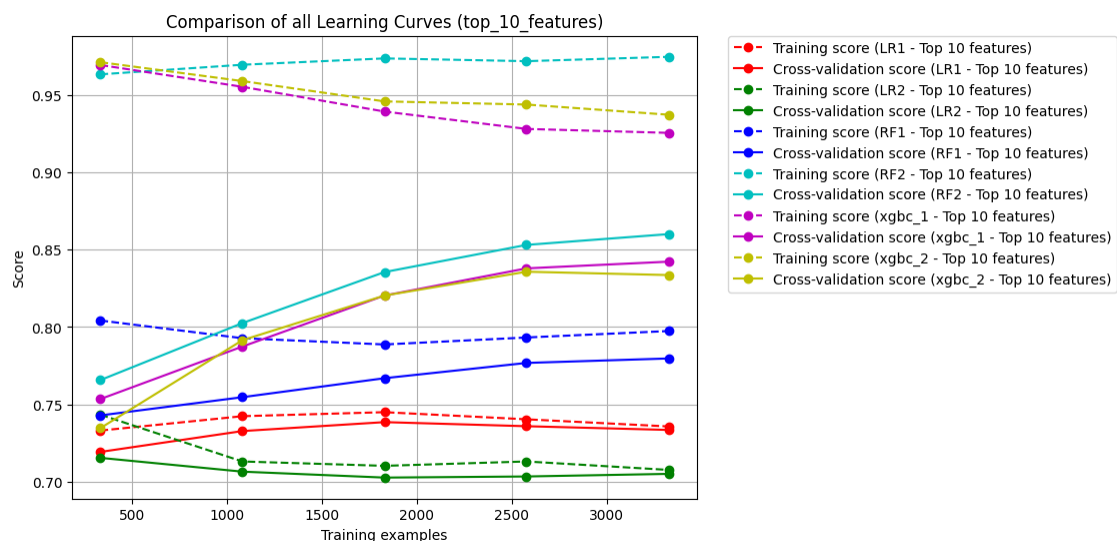
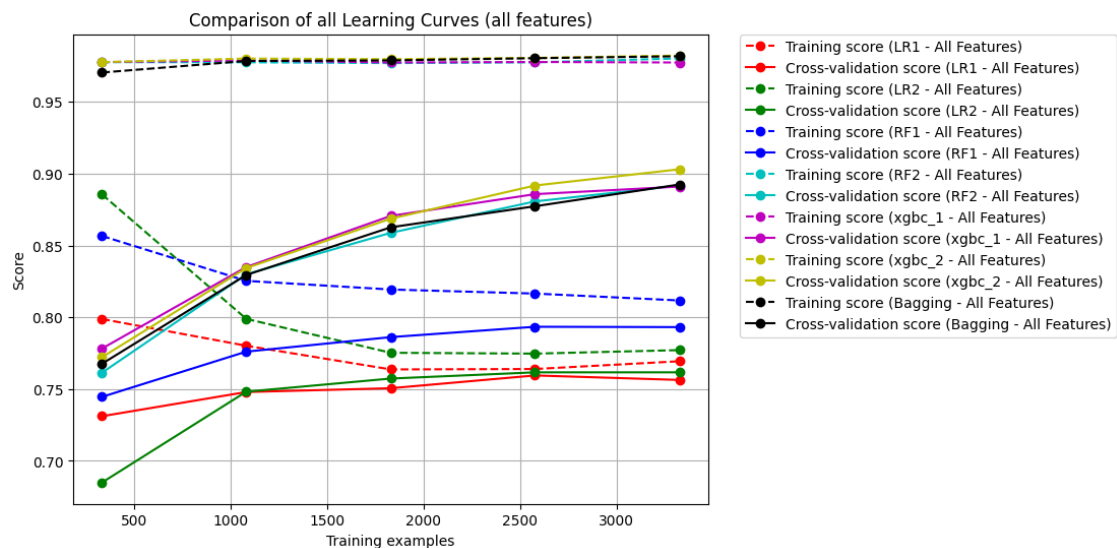
```
clf.plot_learning_curve_comparison(data_sets=data_to_plot_1 + data_to_plot_2 +
    ↪data_to_plot_3, title="Comparison of all Learning Curves",figsize=(30,15)
)
```

```
/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/svm/_base.py:1250: ConvergenceWarning: Liblinear failed to
converge, increase the number of iterations.
```

```
warnings.warn(
```

```
/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/svm/_base.py:1250: ConvergenceWarning: Liblinear failed to
converge, increase the number of iterations.
```

```
warnings.warn(
```



```
/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/svm/_base.py:1250: ConvergenceWarning: Liblinear failed to
converge, increase the number of iterations.
```

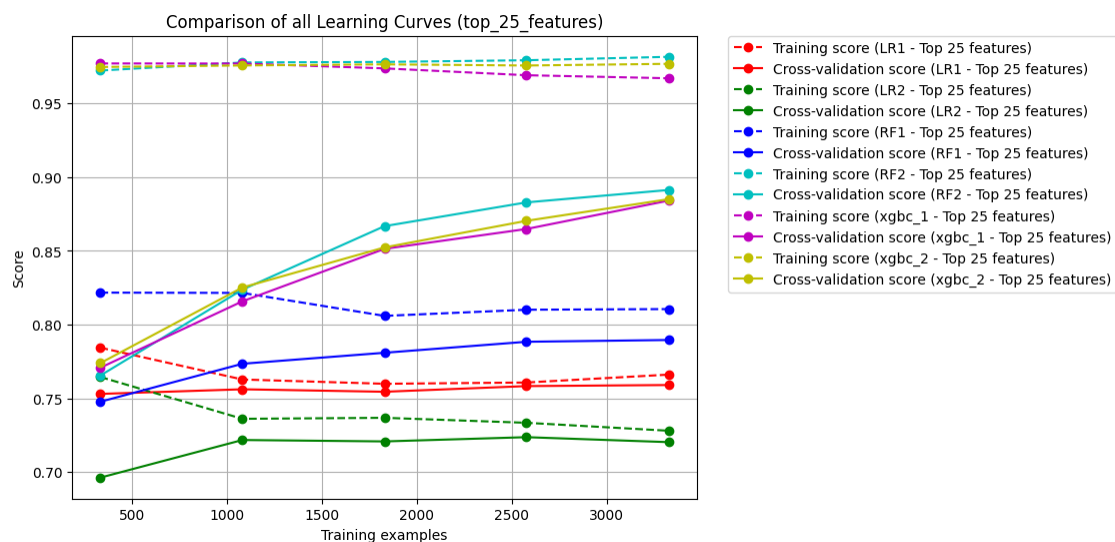
```
warnings.warn(
```

```
/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/svm/_base.py:1250: ConvergenceWarning: Liblinear failed to
converge, increase the number of iterations.
```

```
warnings.warn(
```

```
/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/svm/_base.py:1250: ConvergenceWarning: Liblinear failed to
converge, increase the number of iterations.
```

```
warnings.warn(
```



```
/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/svm/_base.py:1250: ConvergenceWarning: Liblinear failed to
converge, increase the number of iterations.
```

```
warnings.warn(
```

```
/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/svm/_base.py:1250: ConvergenceWarning: Liblinear failed to
converge, increase the number of iterations.
```

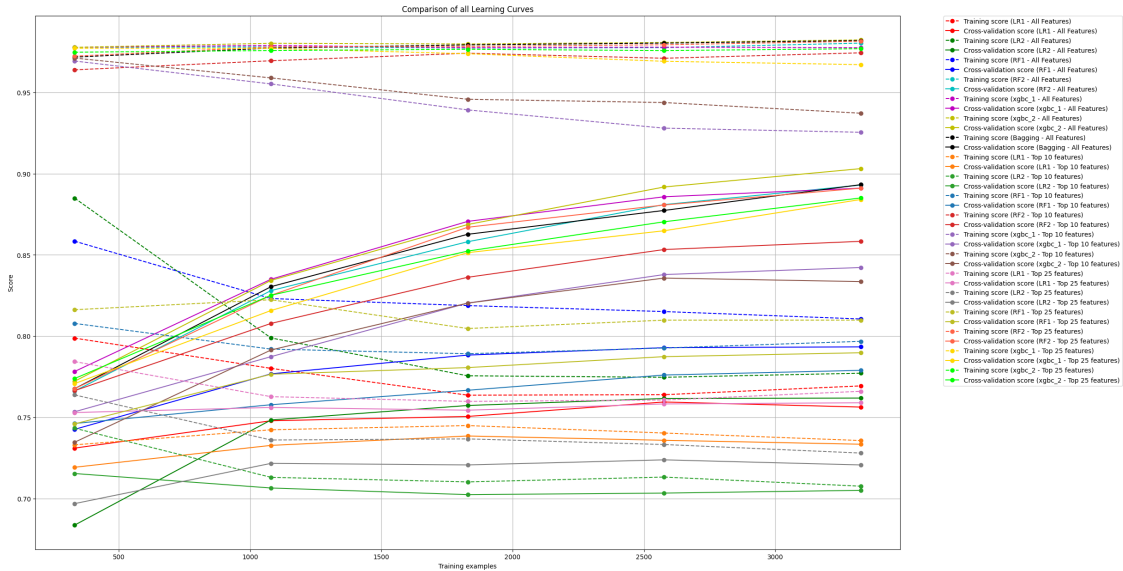
```
warnings.warn(
```

```
/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/svm/_base.py:1250: ConvergenceWarning: Liblinear failed to
converge, increase the number of iterations.
```

```
warnings.warn(
```

```
/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/svm/_base.py:1250: ConvergenceWarning: Liblinear failed to
converge, increase the number of iterations.
```

```
warnings.warn(
/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/svm/_base.py:1250: ConvergenceWarning: Liblinear failed to
converge, increase the number of iterations.
warnings.warn(
/opt/anaconda3/envs/yolov8_env/lib/python3.10/site-
packages/sklearn/svm/_base.py:1250: ConvergenceWarning: Liblinear failed to
converge, increase the number of iterations.
warnings.warn(
```



8 General Model Analysis and Conclusion

Our comprehensive analysis of various classification models has provided clear insights into their performance with both the full feature set and the top 10 most relevant features.

Model Performance with All Features Performance with Top 10 Features Logistic Regression Good baseline. Slight performance drop, showing the value of additional features. Random Forest Excellent. Excellent. XGBoost Excellent, often matching or slightly surpassing Random Forest. Excellent, demonstrating robustness with fewer features. BaggingClassifier Excellent. N/A. Ensemble (VotingClassifier) Excellent performance, with a minor improvement over the best individual model. Excellent performance, with a minor improvement over the best individual model. Best Individual Models

Most Powerful Model: XGBoost emerged as the strongest individual classifier. It is a robust, efficient, and highly predictive model that performs consistently well on both the full and reduced feature sets.

Most Efficient Model: The Random Forest is a close second. It offers excellent performance with less implementation complexity and great stability. While XGBoost is marginally better, Random Forest remains a reliable and powerful choice.

The Overall Best Model: The Ensemble

The absolute best model is the VotingClassifier . While individual models like XGBoost were very strong, the ensemble's ability to combine their strengths and compensate for their weaknesses led to a more robust and accurate final prediction.

9 Save Notebook

```
[ ]: os.environ["PATH"] = "/Library/TeX/texbin:" + os.environ["PATH"]  
     save_as_pdf(ipynbname.path())
```