Classification Report:

precision recall f1-score support

0 0.85 0.94 0.89 484

1 0.46 0.25 0.32 106

accuracy 0.81 590

macro avg 0.66 0.59 0.61 590

weighted avg 0.78 0.81 0.79 590

------------

Model saved as dt\_model.pkl

RandomForestClassifier Accuracy: 0.8424

Classification Report:

precision recall f1-score support

0 0.84 0.99 0.91 484

1 0.84 0.15 0.26 106

accuracy 0.84 590

macro avg 0.84 0.57 0.58 590

weighted avg 0.84 0.84 0.79 590

------------

Model saved as rf\_model.pkl

GaussianNB Accuracy: 0.8305

Classification Report:

precision recall f1-score support

0 0.83 0.99 0.91 484

1 0.71 0.09 0.17 106

accuracy 0.83 590

macro avg 0.77 0.54 0.54 590

weighted avg 0.81 0.83 0.77 590

------------

Model saved as mb\_model.pkl

KNeighborsClassifier Accuracy: 0.7949

Classification Report:

precision recall f1-score support

0 0.87 0.88 0.88 484

1 0.43 0.42 0.43 106

accuracy 0.79 590

macro avg 0.65 0.65 0.65 590

weighted avg 0.79 0.79 0.79 590

------------

Model saved as knn\_model.pkl

SVC Accuracy: 0.8254

Classification Report:

precision recall f1-score support

0 0.87 0.92 0.90 484

1 0.52 0.38 0.44 106

accuracy 0.83 590

macro avg 0.70 0.65 0.67 590

weighted avg 0.81 0.83 0.81 590

------------

Model saved as svm\_model.pkl

odel saved as dt\_model.pkl

RandomForestClassifier Accuracy: 0.8424

Classification Report:

precision recall f1-score support

0 0.84 0.99 0.91 484

1 0.84 0.15 0.26 106

accuracy 0.84 590

macro avg 0.84 0.57 0.58 590

weighted avg 0.84 0.84 0.79 590

------------

Model saved as rf\_model.pkl

GaussianNB Accuracy: 0.8305

Classification Report:

precision recall f1-score support

0 0.83 0.99 0.91 484

1 0.71 0.09 0.17 106

accuracy 0.83 590

macro avg 0.77 0.54 0.54 590

weighted avg 0.81 0.83 0.77 590

------------

Model saved as mb\_model.pkl

KNeighborsClassifier Accuracy: 0.7949

Classification Report:

precision recall f1-score support

0 0.87 0.88 0.88 484

1 0.43 0.42 0.43 106

accuracy 0.79 590

macro avg 0.65 0.65 0.65 590

weighted avg 0.79 0.79 0.79 590

------------

Model saved as knn\_model.pkl

SVC Accuracy: 0.8254

Classification Report:

precision recall f1-score support

0 0.87 0.92 0.90 484

1 0.52 0.38 0.44 106

accuracy 0.83 590

macro avg 0.70 0.65 0.67 590

weighted avg 0.81 0.83 0.81 590

------------

Model saved as svm\_model.pkl

[31]

3s

from sklearn.ensemble import (

    RandomForestClassifier,

    GradientBoostingClassifier,

    StackingClassifier

)

# Gradient Boosting Classifier

gb\_model = GradientBoostingClassifier(random\_state=42, learning\_rate=0.1, n\_estimators=500)

evaluate\_and\_save\_model(gb\_model, X\_train, X\_test, y\_train, y\_test, "gb\_model.pkl")

stacking\_model = StackingClassifier(

    estimators=[

        ('rf', RandomForestClassifier(random\_state=42)),

        ('knn', KNeighborsClassifier()),

        ('svm', SVC(random\_state=42))

    ],

    final\_estimator=LogisticRegression()

)

evaluate\_and\_save\_model(stacking\_model, X\_train, X\_test, y\_train, y\_test, "stacking\_model.pkl")