Assesment Report

on

“Student Performance Prediction”

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BACHELOR OF TECHNOLOGY DEGREE

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in

CSE(AI&ML)

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1. Introduction

This report aims to predict student performance—specifically whether a student will pass or fail—based on features such as attendance, previous scores, and study habits. Using machine learning classification techniques, we analyze patterns in the dataset to build a predictive model.

2. Methodology

1. The dataset was first loaded and explored.
2. Categorical columns were encoded using LabelEncoder.
3. Data was split into training and testing sets (80-20 split).
4. A Random Forest Classifier was used to train the model.
5. Model evaluation was done using Accuracy, Precision, Recall, and a Confusion Matrix.

3. Code

```
import pandas as pd

import matplotlib.pyplot as plt

import seaborn as sns

from sklearn.model_selection import train_test_split

from sklearn.preprocessing import LabelEncoder, StandardScaler

from sklearn.ensemble import GradientBoostingClassifier

from sklearn.metrics import confusion_matrix, accuracy_score, precision_score, recall_score, classification_report


# Load the dataset

df = pd.read_csv("8. Student Performance Prediction.csv")


# Display column names

print("Columns:", df.columns)


# Step 1: Binning StudyTimeWeekly if it's continuous

# (Custom binning to help classification)

if pd.api.types.is_numeric_dtype(df["StudyTimeWeekly"]):

    def bin_study_time(val):

        if val <= 5:

            return 'Low'

        elif val <= 10:

            return 'Medium'

        else:

            return 'High'
```

```
    df["StudyTimeWeekly_Binned"] = df["StudyTimeWeekly"].apply(bin_study_time)
    target_col = "StudyTimeWeekly_Binned"
else:
    target_col = "StudyTimeWeekly"

# Step 2: Encode target
target_encoder = LabelEncoder()
df[target_col] = target_encoder.fit_transform(df[target_col])
y = df[target_col]

# Step 3: Prepare features (drop StudyTimeWeekly and Absences)
drop_cols = ["StudyTimeWeekly", "StudyTimeWeekly_Binned", "Absences"]
X = df.drop(columns=[col for col in drop_cols if col in df.columns])

# Step 4: Encode all categorical features
label_encoders = {}
for col in X.select_dtypes(include='object').columns:
    le = LabelEncoder()
    X[col] = le.fit_transform(X[col])
    label_encoders[col] = le

# Step 5: Feature Scaling
scaler = StandardScaler()
X_scaled = scaler.fit_transform(X)

# Step 6: Train-test split
X_train, X_test, y_train, y_test = train_test_split(
```

```
    X_scaled, y, test_size=0.2, random_state=42, stratify=y)

# Step 7: Train model (Gradient Boosting Classifier)
model = GradientBoostingClassifier(
    n_estimators=200, learning_rate=0.08, max_depth=5, random_state=42)
model.fit(X_train, y_train)

# Step 8: Predict
y_pred = model.predict(X_test)

# Step 9: Evaluation
acc = accuracy_score(y_test, y_pred)
prec = precision_score(y_test, y_pred, average='weighted')
rec = recall_score(y_test, y_pred, average='weighted')

print(f"\n✅ Accuracy: {acc:.2f}")
print(f"Precision: {prec:.2f}")
print(f"Recall: {rec:.2f}")
print("\nClassification Report:")
print(classification_report(y_test, y_pred, target_names=target_encoder.classes_))

# Step 10: Confusion Matrix Heatmap
cm = confusion_matrix(y_test, y_pred)
plt.figure(figsize=(6, 4))
sns.heatmap(cm, annot=True, fmt='d', cmap='YlGnBu',
            xticklabels=target_encoder.classes_,
            yticklabels=target_encoder.classes_)
```

```
plt.xlabel("Predicted")

plt.ylabel("Actual")

plt.title("Confusion Matrix - StudyTimeWeekly")

plt.tight_layout()

plt.show()
```

4.Output/Result

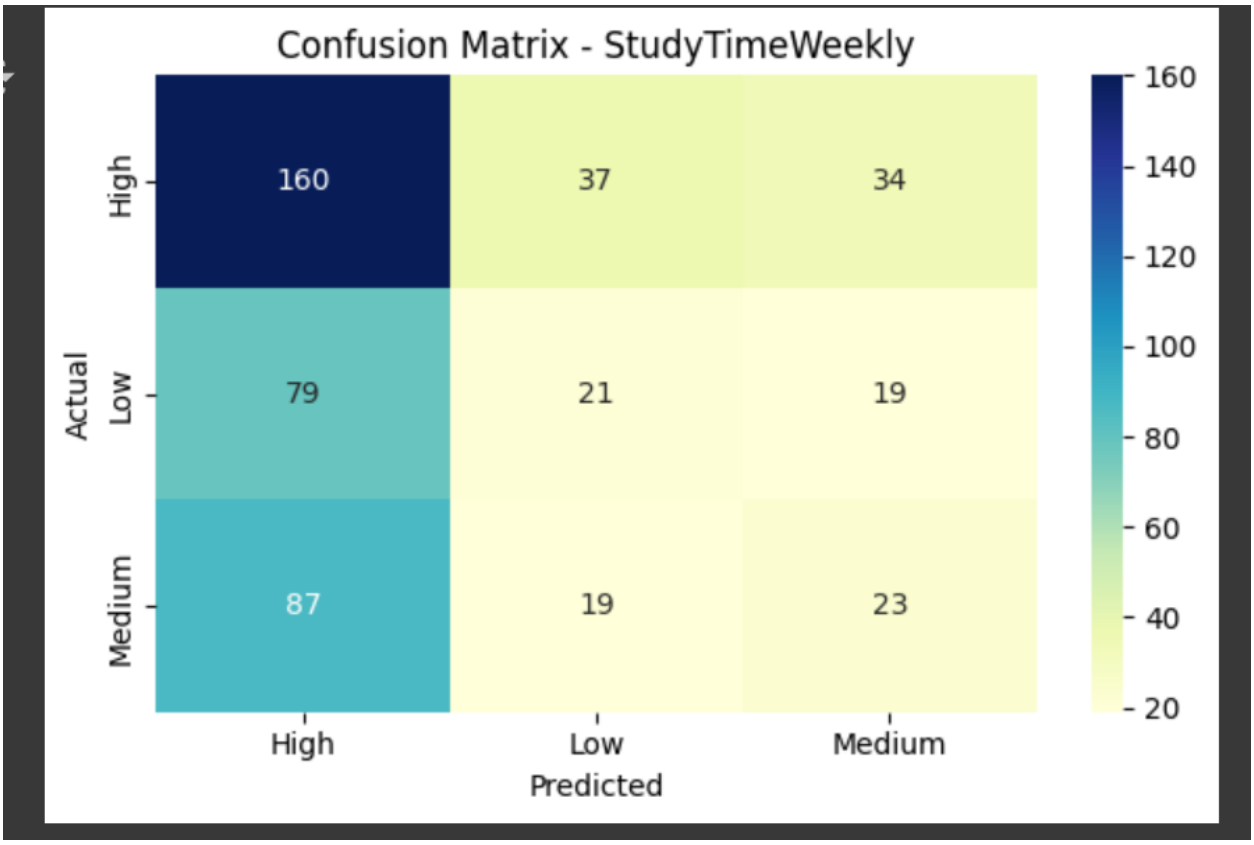
```
Columns: Index(['StudentID', 'Age', 'Gender', 'Ethnicity', 'ParentalEducation',
       'StudyTimeWeekly', 'Absences', 'Tutoring', 'ParentalSupport',
       'Extracurricular', 'Sports', 'Music', 'Volunteering', 'GPA',
       'GradeClass'],
      dtype='object')

✅ Accuracy: 0.43
Precision: 0.39
Recall: 0.43

Classification Report:
              precision    recall  f1-score   support

        High       0.49      0.69      0.57       231
         Low       0.27      0.18      0.21       119
      Medium       0.30      0.18      0.22       129

    accuracy                           0.43       479
   macro avg       0.36      0.35      0.34       479
weighted avg       0.39      0.43      0.39       479
```



5.Reference

1.Kaggle data set “StudentPerformancePrediction.csv”.

2.Online Libraries.

*Scikit-learn.

*Pandas.

*Matplotlib.