Assessment Report

on

“Student Performance Prediction"

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BACHELOR OF TECHNOLOGY DEGREE

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in

CSE AIML(C)

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Introduction

Student performance prediction is a key challenge in the education domain. By analyzing attributes such as attendance, study habits, and participation in extracurricular activities, we can predict whether a student is likely to pass or fail. This helps educators and institutions take proactive steps for academic improvement.

The aim of this project is to build a classification model that predicts a student's academic outcome (Pass/Fail) using machine learning techniques.

Methodology

1. Dataset Overview

We used a dataset containing features like:

- Attendance (Absences)
- Weekly Study Time
- Participation in tutoring, extracurriculars, volunteering, sports, etc.
- Parental support and education
- Age and GPA

2. Data Preprocessing

- Created a binary target column Pass, where students with GPA ≥ 2.0 are labeled as 1 (Pass), otherwise 0 (Fail).
- Selected 10 relevant features and split the dataset into training and testing sets (80/20 split).

3. Model Used

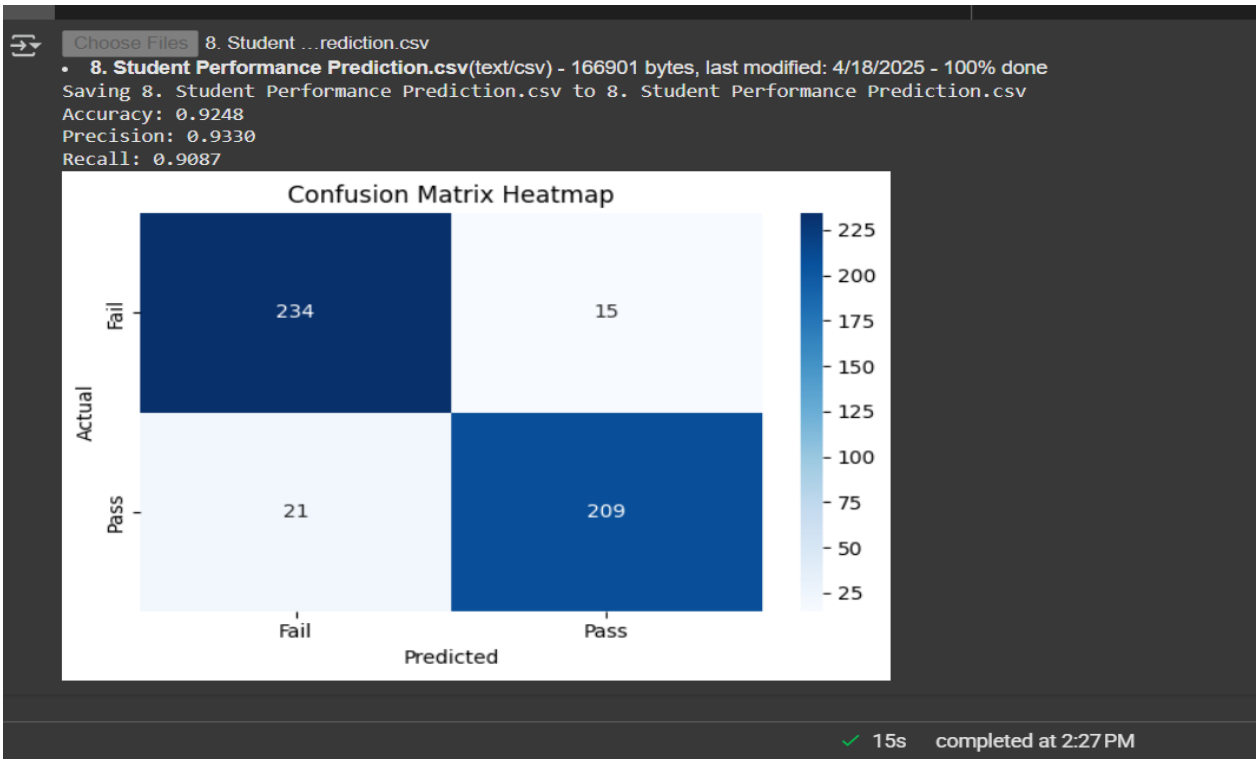
- A **Random Forest Classifier** was trained to handle the classification task.
- Evaluation was done using confusion matrix, accuracy, precision, and recall.

Code

```
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
from sklearn.model_selection import train_test_split
from sklearn.ensemble import RandomForestClassifier
from sklearn.metrics import confusion_matrix, accuracy_score, precision_score, recall_score

# Load the CSV
df = pd.read_csv("8. Student Performance Prediction.csv")

# Create binary target
df['Pass'] = (df['GPA'] >= 2.0).astype(int)

# Select features
features = [
    'Absences', 'StudyTimeWeekly', 'Tutoring',
    'ParentalSupport', 'Extracurricular', 'Sports',
    'Music', 'Volunteering', 'ParentalEducation', 'Age'
]
X = df[features]
y = df['Pass']

# Train-test split
X_train, X_test, y_train, y_test = train_test_split(
    X, y, test_size=0.2, random_state=42
)

# Train model
model = RandomForestClassifier(random_state=42)
model.fit(X_train, y_train)
y_pred = model.predict(X_test)

# Evaluation
conf_mat = confusion_matrix(y_test, y_pred)
accuracy = accuracy_score(y_test, y_pred)
precision = precision_score(y_test, y_pred)
recall = recall_score(y_test, y_pred)

# Print scores
print(f"Accuracy: {accuracy:.4f}")
print(f"Precision: {precision:.4f}")
print(f"Recall: {recall:.4f}")
```

```
# Heatmap
plt.figure(figsize=(6, 4))
sns.heatmap(conf_mat, annot=True, fmt='d', cmap='Blues',
        xticklabels=['Fail', 'Pass'], yticklabels=['Fail', 'Pass'])
plt.xlabel('Predicted')
plt.ylabel('Actual')
plt.title('Confusion Matrix Heatmap')
plt.tight_layout()
plt.show()
```

Result



- **Accuracy**: 92.48%
- **Precision**: 93.30%
- **Recall**: 90.87%

The confusion matrix heatmap indicates that the model performs well in classifying both Pass and Fail cases. Random Forests handled the task efficiently with minimal tuning.

References

1. Dataset Source: *[Provided by Instructor / Assignment Portal]*
2. Scikit-learn Documentation: https://scikit-learn.org
3. Seaborn & Matplotlib Documentation: https://seaborn.pydata.org | https://matplotlib.org
4. "Introduction to Machine Learning" – Andrew Ng, Coursera