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on

“STUDENT PERFORMACE PREDICTION”

submitted as partial fulfillment for the award

BACHELOR OF TECHNOLOGY DEGREE

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in

CSE AIML

By

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STUDENT PERFORMANCE PREDICTION

Student performance prediction involves using historical academic and personal data to forecast how a student is likely to perform in the future. Machine learning models analyze patterns in various factors such as:

- **Demographics** (age, gender, family background)
- **Academic records** (grades, attendance, study hours)
- **Behavioral data** (participation, discipline records)

The goal is to:

- Identify students at risk of underperforming
- Offer personalized support or interventions
- Improve teaching strategies and academic outcomes

Common algorithms used include **Linear Regression**, **Decision**

Decision Random Forest, and **Support Vector Machines**. These models can predict final grades, exam scores, or even pass/fail outcomes with considerable accuracy.

Overall, it's a powerful tool for data-driven decision-making in education.

METHODOLOGY

1. Problem Definition

Define the objective:

Predict student performance (e.g., final grade or score) based on various input features like study time, attendance, socio-economic factors, etc.

2. Data Collection

Use a dataset containing:

- Academic records (grades, attendance)
- Demographic info (age, gender, parental education)
- Behavioral aspects (study time, failures, support)

3. Data Preprocessing

- **Handle Missing Values**: Fill or drop missing data
- **Data Cleaning**: Remove duplicates, fix inconsistencies
- **Encoding**: Convert categorical variables using one-hot encoding or label encoding
- **Feature Scaling** (optional): Normalize or standardize if needed for some models

4. Exploratory Data Analysis (EDA)

- Analyze relationships between features and the target
- Visualize using histograms, boxplots , heatmaps
- Check for multicollinearity and distribution

5. Model Building

Train models:

- Linear Regression

- Random Forest Regressor
- Decision Tree
- XGBoost, etc.

6. Model Evaluation

Use metrics like:

- **MAE** (Mean Absolute Error)
- **MSE / RMSE** (Mean Squared Error)
- **R² Score** (explains variance)

Visualize:

- Actual vs Predicted
- Residual plots

7. Model Optimization

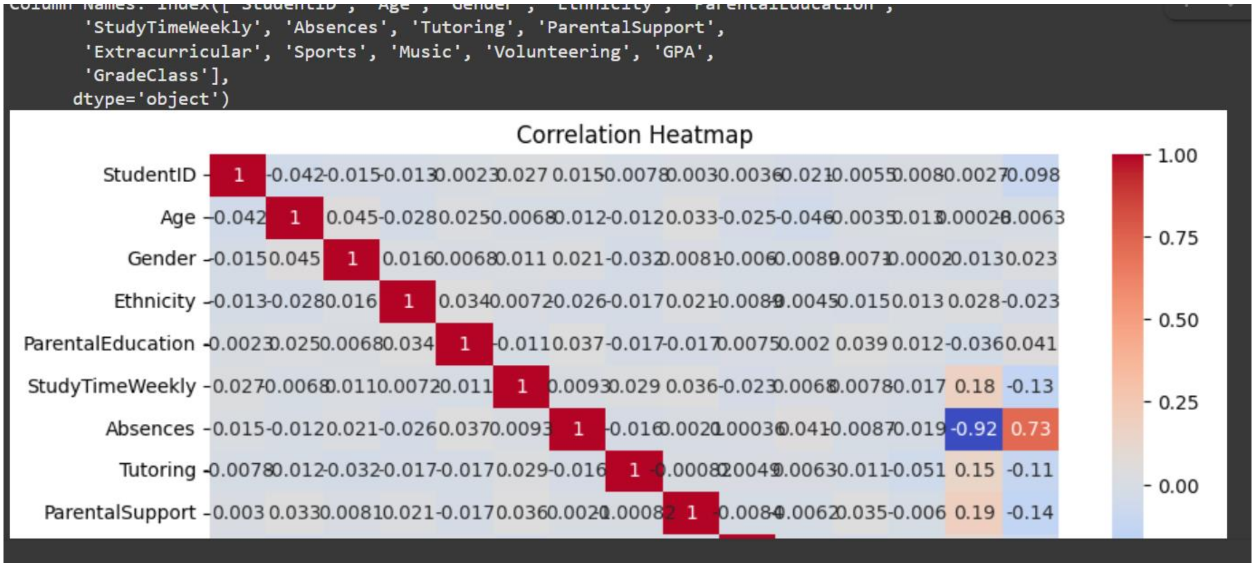
- Hyperparameter tuning (Grid Search, Randomized Search)
- Cross-validation for stable results

CODE

```python
 Step 1: Upload the CSV file
from google.colab import files
uploaded = files.upload()

# Step 2: Load the dataset
import pandas as pd

# Use the exact file name from the upload
df = pd.read_csv('8. Student Performance Prediction.csv')

# Step 3: Preview the dataset
print("First 5 rows:")
print(df.head())

print("\nDataset Info:")
df.info()

print("\nMissing Values:")
print(df.isnull().sum())

# Step 4: Basic EDA
import seaborn as sns
import matplotlib.pyplot as plt

# Distribution of target (assumes last column is the target, adjust if needed)
print("\nColumn Names:", df.columns)

# Visualize correlation
plt.figure(figsize=(10, 6))
sns.heatmap(df.corr(numeric_only=True), annot=True, cmap='coolwarm')
plt.title("Correlation Heatmap")
plt.show()

# Step 5: Preprocess data
# Automatically detect categorical variables
categorical_cols = df.select_dtypes(include='object').columns
df = pd.get_dummies(df, columns=categorical_cols, drop_first=True)

# Assuming the target is the last column
X = df.iloc[:, :-1]
y = df.iloc[:, -1]

# Step 6: Train/test split
from sklearn.model_selection import train_test_split

X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)

# Step 7: Train a Random Forest model
from sklearn.ensemble import RandomForestRegressor
from sklearn.metrics import mean_absolute_error, mean_squared_error, r2_score

model = RandomForestRegressor(n_estimators=100, random_state=42)
model.fit(X_train, y_train)
```

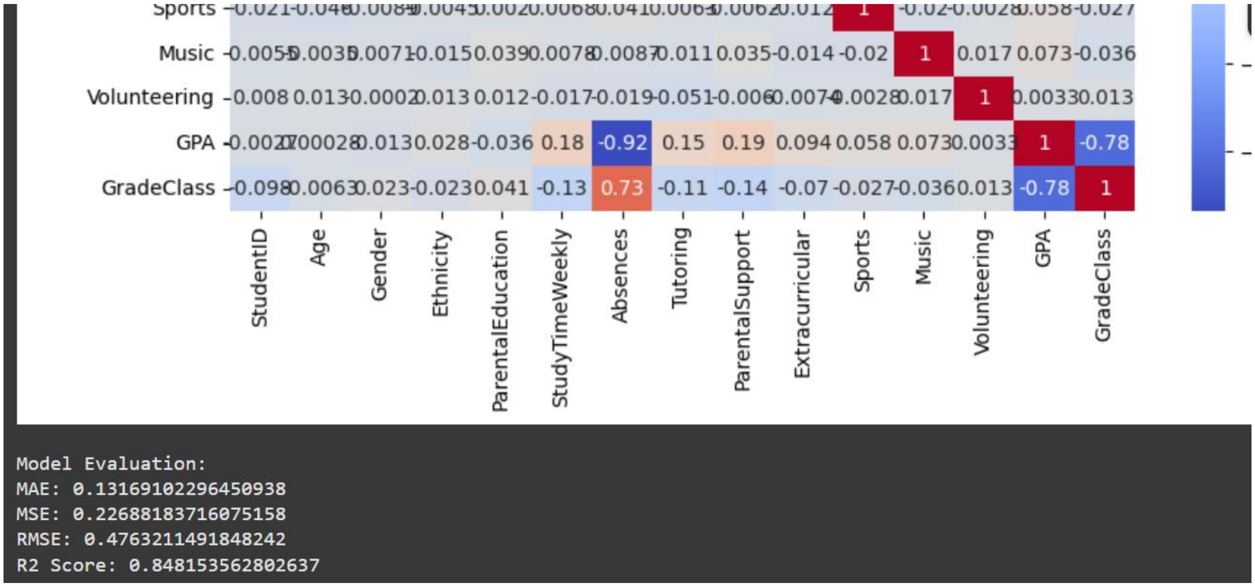
```python
# Step 8: Evaluate the model
y_pred = model.predict(X_test)

print("\nModel Evaluation:")
print("MAE:", mean_absolute_error(y_test, y_pred))
print("MSE:", mean_squared_error(y_test, y_pred))

print("RMSE:", np.sqrt(mean_squared_error(y_test, y_pred)))

print("R2 Score:", r2_score(y_test, y_pred))
```

OUTPUT



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

Correlation Heatmap
StudentID 1 -0.042 -0.015 -0.013 0.0023 0.027 0.015 -0.0078 0.003 -0.0036 -0.021 -0.0055 0.008 -0.0027 -0.098
Age -0.042 1 0.045 -0.028 0.025 -0.0068 -0.012 -0.012 0.033 -0.025 -0.046 -0.0035 0.013 0.00028 -0.0063
Gender -0.015 0.045 1 0.016 0.0068 0.011 0.021 -0.032 0.0081 -0.006 -0.0089 0.0071 -0.0002 0.013 0.023
Ethnicity -0.013 -0.028 0.016 1 0.034 0.0072 -0.026 -0.017 0.021 -0.0089 -0.0045 -0.015 0.013 0.028 -0.023
ParentalEducation 0.0023 0.025 0.0068 0.034 1 -0.011 0.037 -0.017 -0.017 0.0075 0.002 0.039 0.012 -0.036 0.041
StudyTimeWeekly 0.027 -0.0068 0.011 0.0072 -0.011 1 0.0093 0.029 0.036 -0.023 0.0068 0.0078 -0.017 0.18 -0.13
Absences 0.015 -0.012 0.021 -0.026 0.037 0.0093 1 -0.016 0.0020 0.00036 0.041 -0.0087 -0.019 -0.92 0.73
Tutoring -0.0078 0.012 -0.032 -0.017 -0.017 0.029 -0.016 1 -0.00082 0.0049 0.0063 -0.011 -0.051 0.15 -0.11
ParentalSupport 0.003 0.033 0.0081 0.021 -0.017 0.036 0.0020 -0.00082 1 -0.0084 -0.0062 0.035 -0.006 0.19 -0.14
1.00
0.75
0.50
0.25
0.00



Sports -0.021 -0.046 -0.0089 -0.0045 0.002 0.0068 0.041 0.0063 -0.0062 -0.012 1 -0.02 -0.0028 0.058 -0.027
Music -0.0055 -0.0035 0.0071 -0.015 0.039 0.0078 -0.0087 -0.011 0.035 -0.014 -0.02 1 0.017 0.073 -0.036
Volunteering -0.008 0.013 -0.0002 0.013 0.012 -0.017 -0.019 -0.051 -0.006 -0.0074 -0.0028 0.017 1 0.0033 0.013
GPA -0.0027 0.00028 0.013 0.028 -0.036 0.18 -0.92 0.15 0.19 0.094 0.058 0.073 0.0033 1 -0.78
GradeClass -0.098 -0.0063 0.023 -0.023 0.041 -0.13 0.73 -0.11 -0.14 -0.07 -0.027 -0.036 0.013 -0.78 1
StudentID
Age
Gender
Ethnicity
ParentalEducation
StudyTimeWeekly
Absences
Tutoring
ParentalSupport
Extracurricular
Sports
Music
Volunteering
GPA
GradeClass

```
Model Evaluation:
MAE: 0.13169102296450938
MSE: 0.22688183716075158
RMSE: 0.4763211491848242
R2 Score: 0.848153562802637
```

REFRENCES

Kaggle :-https://www.kaggle.com/datasets

chatgpt