Assessment Report

on

"Traffic Volume Prediction"

submitted as partial fulfillment for the award of

BACHELOR OF TECHNOLOGY DEGREE

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in

CSEAI

By

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Introduction

Problem Statement:
The goal of this project is to build a regression model that predicts traffic volume on interstate highways based on weather conditions and time-related features. This is useful for city planners, traffic management systems, and smart city applications to prevent traffic congestion and improve commute efficiency.

Dataset Used:
The dataset is taken from Kaggle (via kagglehub), named **Metro Interstate Traffic Volume**, and contains hourly traffic volume data alongside weather information and timestamps.

Motivation:
Predicting traffic volume using machine learning can help improve traffic flow, reduce pollution, and provide real-time solutions in smart cities.

Methodology

Step 1: Data Collection

- The dataset was downloaded using the KaggleHub API.
- It contains features like temperature, rain, snow, clouds, and datetime.

Step 2: Data Preprocessing & Feature Engineering

- Converted datetime into useful time features like hour, day_of_week, and month.
- Added is_weekend as a binary feature (0 for weekdays, 1 for weekends).
- Removed irrelevant columns for this task.

Step 3: Model Selection

- Used a basic **Linear Regression** model for simplicity and interpretability.
- Split the data into 80% training and 20% testing sets.

Step 4: Training and Evaluation

- Trained the model on the training set.
- Evaluated using **Mean Squared Error (MSE)**.

Step 5: Visualization

- Created scatter plots to visualize actual vs predicted traffic volume.
- Created a correlation heatmap to show relationships between features.

CODE:

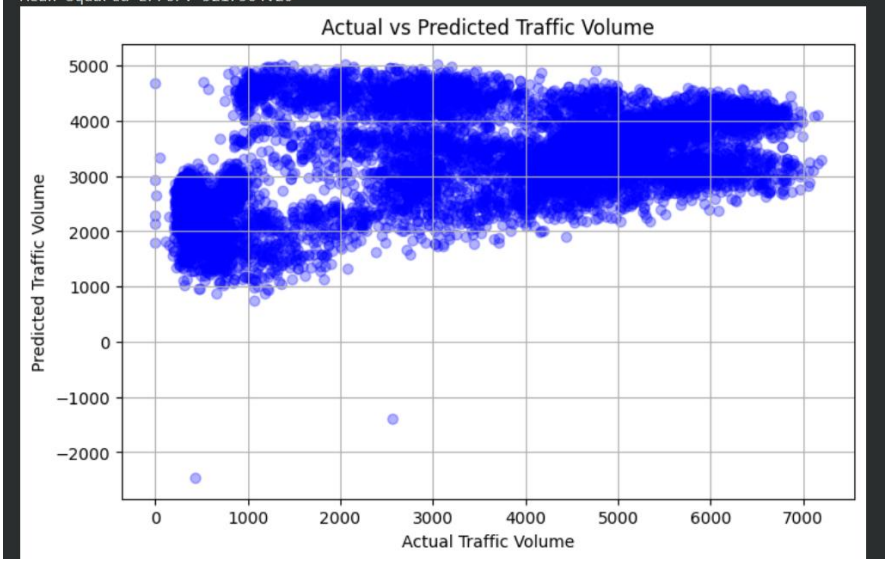
```
import kagglehub
# Download latest version
path = kagglehub.dataset_download("rgupta12/metro-interstate-traffic-volume")

import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression
from sklearn.metrics import mean_squared_error, r2_score

csv_path = f"{path}/Metro_Interstate_Traffic_Volume.csv"

# Step 2: Load Data
df = pd.read_csv(csv_path)
print("Dataset shape:", df.shape)
print(df.head())

# Step 3: Feature Engineering
df['date_time'] = pd.to_datetime(df['date_time'])
df['hour'] = df['date_time'].dt.hour
df['day_of_week'] = df['date_time'].dt.dayofweek
```

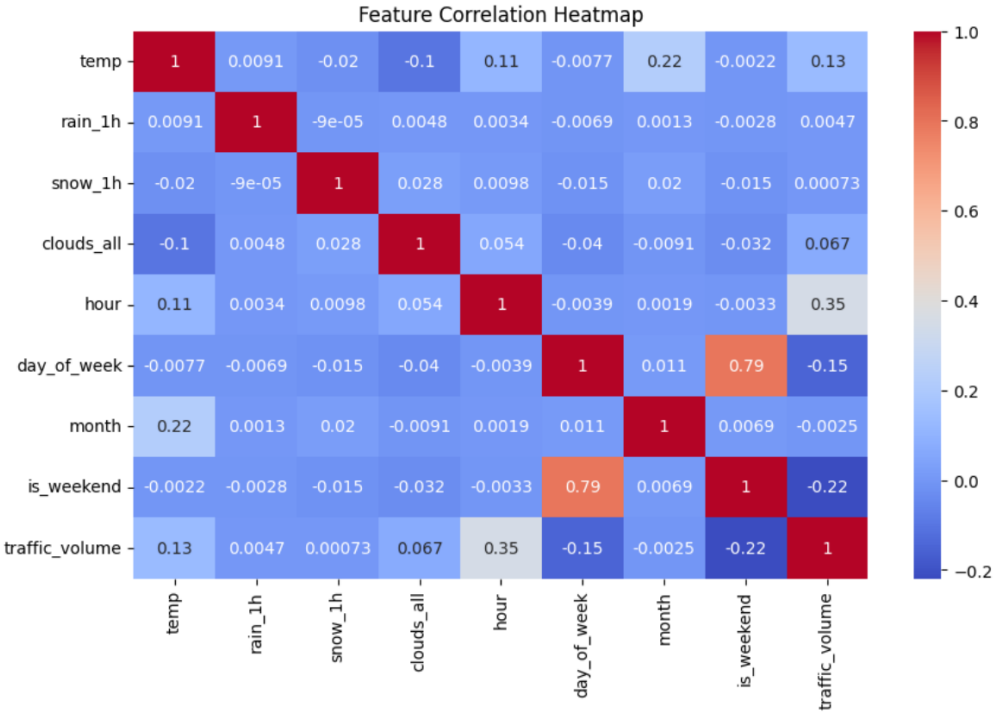
```
df['month'] = df['date_time'].dt.month

df['is_weekend'] = df['day_of_week'].apply(lambda x: 1 if x >= 5 else 0)


# Step 4: Select Features

features = ['temp', 'rain_1h', 'snow_1h', 'clouds_all', 'hour', 'day_of_week',
'month', 'is_weekend']

X = df[features]

y = df['traffic_volume']


# Step 5: Split Dataset

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


# Step 6: Train Model

model = LinearRegression()

model.fit(X_train, y_train)


# Step 7: Predict

y_pred = model.predict(X_test)


# Step 8: Evaluate

mse = mean_squared_error(y_test, y_pred)

print(f"Mean Squared Error: {mse:.2f}")


# Step 9: Visualize Actual vs Predicted
```

```
plt.figure(figsize=(8,5))
plt.scatter(y_test, y_pred, alpha=0.3, color='blue')
plt.xlabel("Actual Traffic Volume")
plt.ylabel("Predicted Traffic Volume")
plt.title("Actual vs Predicted Traffic Volume")
plt.grid(True)
plt.show()

# Step 10: Correlation Heatmap
plt.figure(figsize=(10,6))
sns.heatmap(df[features + ['traffic_volume']].corr(), annot=True,
cmap='coolwarm')
plt.title("Feature Correlation Heatmap")
plt.show()
```

Output/Result

```
Dataset shape: (48204, 9)
  holiday    temp  ...            date_time  traffic_volume
0     NaN  288.28  ...  2012-10-02 09:00:00            5545
1     NaN  289.36  ...  2012-10-02 10:00:00            4516
2     NaN  289.58  ...  2012-10-02 11:00:00            4767
3     NaN  290.13  ...  2012-10-02 12:00:00            5026
4     NaN  291.14  ...  2012-10-02 13:00:00            4918

[5 rows x 9 columns]
Mean Squared Error: 3217364.20
```





References/Credits

- **Dataset**: Metro Interstate Traffic Volume – Kaggle
- **Code Assistance**: Implemented using Python, scikit-learn, pandas, and matplotlib
- **IDE**: Jupyter Notebook / VS Code
- **API**: KaggleHub for downloading the dataset
- **Libraries**:
    - pandas – data handling
    - sklearn – model training
    - matplotlib and seaborn – visualization