In [2]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns

print("All libraries loaded successfully!")
```

```
All libraries loaded successfully!
```

In [6]:
```
import pandas as pd

# بارگذاری دیتاست
df = pd.read_csv("Metro_Interstate_Traffic_Volume.csv")

# نمایش 5 سطر اول
df.head()
```

Out[6]:

	holiday	temp	rain_1h	snow_1h	clouds_all	weather_main	weather_description
0	NaN	288.28	0.0	0.0	40	Clouds	scattered clouds
1	NaN	289.36	0.0	0.0	75	Clouds	broken clouds
2	NaN	289.58	0.0	0.0	90	Clouds	overcast clouds
3	NaN	290.13	0.0	0.0	90	Clouds	overcast clouds
4	NaN	291.14	0.0	0.0	75	Clouds	broken clouds

In [7]:
```
# اطلاعات کلی دیتاست
df.info()

# بررسی وجود مقادیر خالی
df.isnull().sum()

# نمایش چند سطر تصادفی
df.sample(5)
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 48204 entries, 0 to 48203
Data columns (total 9 columns):
 #   Column               Non-Null Count  Dtype  
---  ------               --------------  -----  
 0   holiday              61 non-null     object 
 1   temp                 48204 non-null  float64
 2   rain_1h              48204 non-null  float64
 3   snow_1h              48204 non-null  float64
 4   clouds_all           48204 non-null  int64  
 5   weather_main         48204 non-null  object 
 6   weather_description  48204 non-null  object 
 7   date_time            48204 non-null  object 
 8   traffic_volume       48204 non-null  int64  
dtypes: float64(3), int64(2), object(4)
memory usage: 3.3+ MB
```

Out[7]:

	holiday	temp	rain_1h	snow_1h	clouds_all	weather_main	weather_descripti
5532	NaN	283.03	0.0	0.0	40	Clouds	scattered clou
17228	NaN	293.77	0.0	0.0	75	Rain	light ra
232	NaN	282.20	0.0	0.0	75	Clouds	broken clou
23337	NaN	276.57	0.0	0.0	90	Clouds	overcast clou
46568	NaN	295.34	0.0	0.0	5	Clear	sky is cle

In [8]:

```
# نمایش اطلاعات کلی
df.info()

# تعداد مقادیر خالی در هر ستون
df.isnull().sum()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 48204 entries, 0 to 48203
Data columns (total 9 columns):
 #   Column               Non-Null Count  Dtype  
---  ------               --------------  -----  
 0   holiday              61 non-null     object 
 1   temp                 48204 non-null  float64
 2   rain_1h              48204 non-null  float64
 3   snow_1h              48204 non-null  float64
 4   clouds_all           48204 non-null  int64  
 5   weather_main         48204 non-null  object 
 6   weather_description  48204 non-null  object 
 7   date_time            48204 non-null  object 
 8   traffic_volume       48204 non-null  int64  
dtypes: float64(3), int64(2), object(4)
memory usage: 3.3+ MB
```

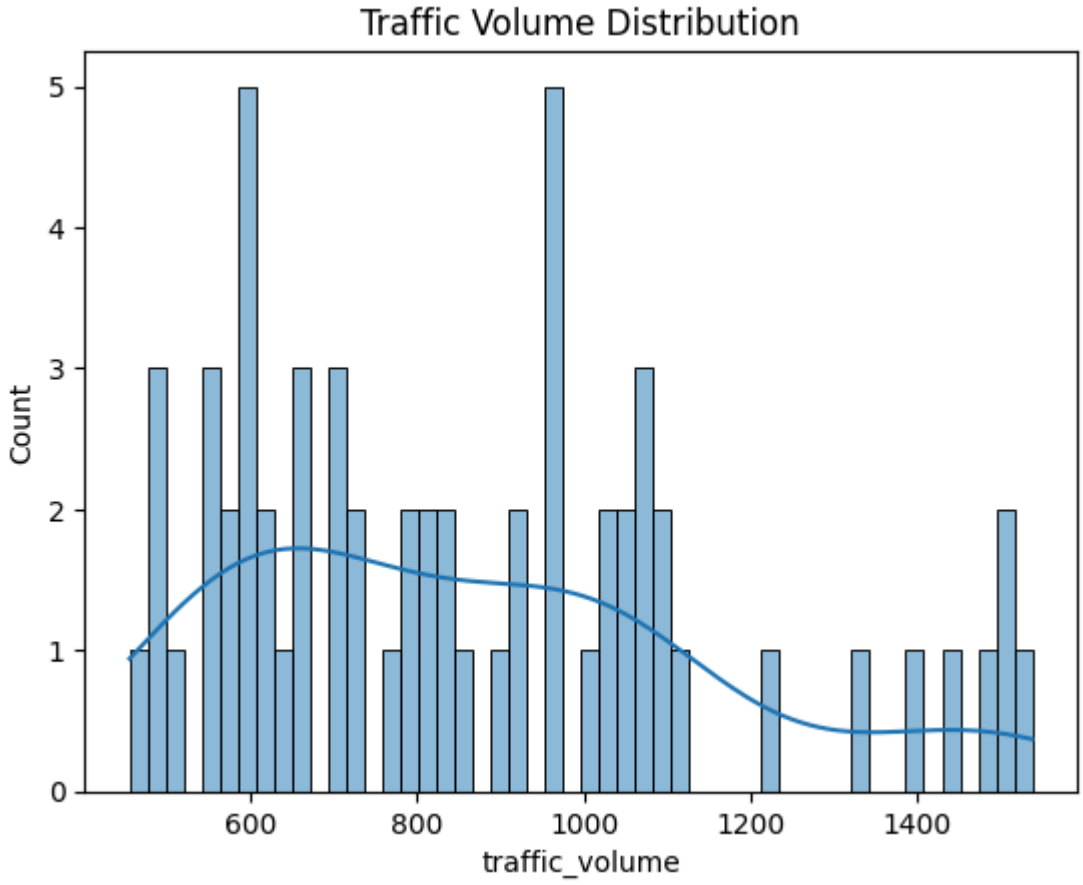
Out[8]:
```
holiday                48143
temp                       0
rain_1h                    0
snow_1h                    0
clouds_all                 0
weather_main               0
weather_description        0
date_time                  0
traffic_volume             0
dtype: int64
```

In [9]:
```
# حذف ردیف‌هایی که مقادیر خالی دارند
df = df.dropna()
```

In [10]:
```
X = df[['traffic_volume']]
```

In [11]:
```
from sklearn.preprocessing import StandardScaler

scaler = StandardScaler()
X_scaled = scaler.fit_transform(X)
```

In [12]:
```
import matplotlib.pyplot as plt
import seaborn as sns

sns.histplot(df['traffic_volume'], bins=50, kde=True)
plt.title("Traffic Volume Distribution")
plt.show()
```



In [13]:
```
from sklearn.ensemble import IsolationForest

# مدل Isolation Forest
```

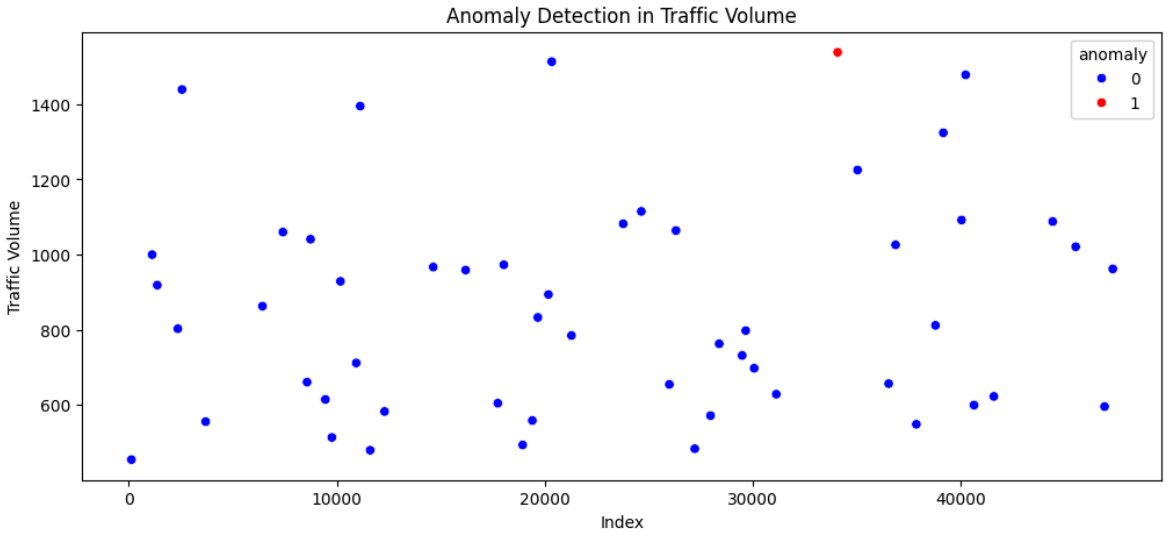
```
model = IsolationForest(contamination=0.01, random_state=42)  # 1% ناهنجار
model.fit(X_scaled)

# پیش‌بینی ناهنجاری‌ها
df['anomaly'] = model.predict(X_scaled)

# 1- :تبدیل خروجی = anomaly، 1 = normal → 1 = anomaly، 0 = normal
df['anomaly'] = df['anomaly'].map({1:0, -1:1})

# نمایش چند نمونه ناهنجار
df[df['anomaly']==1].head()
```

Out[13]:

	holiday	temp	rain_1h	snow_1h	clouds_all	weather_main	weather_descrip
34095	Memorial Day	285.87	0.0	0.0	40	Clouds	scattered clo

In [14]:

```
plt.figure(figsize=(12,5))
sns.scatterplot(data=df, x=df.index, y='traffic_volume', hue='anomaly', p
plt.title("Anomaly Detection in Traffic Volume")
plt.xlabel("Index")
plt.ylabel("Traffic Volume")
plt.show()
```



In [15]:

```
num_anomalies = df['anomaly'].sum()
total = len(df)
print(f"تعداد ناهنجاری‌ها: {num_anomalies} از {total} ردیف ({num_anomalies
```

تعداد ناهنجاری‌ها: 1 از 61 ردیف (1.64%)

In [16]:

```
df[df['anomaly']==1].head(10)
```

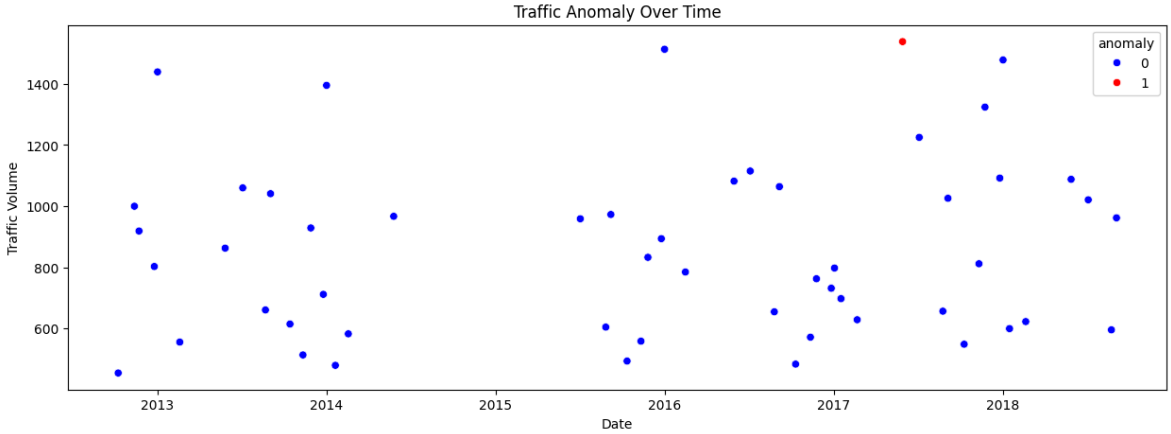
Out[16]:

	holiday	temp	rain_1h	snow_1h	clouds_all	weather_main	weather_descrip
34095	Memorial Day	285.87	0.0	0.0	40	Clouds	scattered clo

In [17]:

```
# تبدیل شده datetime مطمئن شو ستون
df['date_time'] = pd.to_datetime(df['date_time'])
```

```
plt.figure(figsize=(15,5))
sns.scatterplot(data=df, x='date_time', y='traffic_volume', hue='anomaly'
plt.title("Traffic Anomaly Over Time")
plt.xlabel("Date")
plt.ylabel("Traffic Volume")
plt.show()
```



In [18]:
```
df.to_csv("traffic_with_anomalies.csv", index=False)
```