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Implement programs for estimating & eliminating trend in time series data- aggregation, smoothing.

Aim:

Write a program to estimating & eliminating trend in time series data- aggregation, smoothing.

Algorithm:

Load the Data

- Read `data.csv`
- Parse the `date` column and set it as index

Clean the Data

- Fill missing values
- Drop any NaNs

Aggregation (Trend Estimation)

- Use resampling (e.g., monthly mean) to observe trend

Smoothing (Trend Removal)

- Use **rolling mean (moving average)** to smooth the trend
- Detrend by subtracting the rolling mean

Visualization

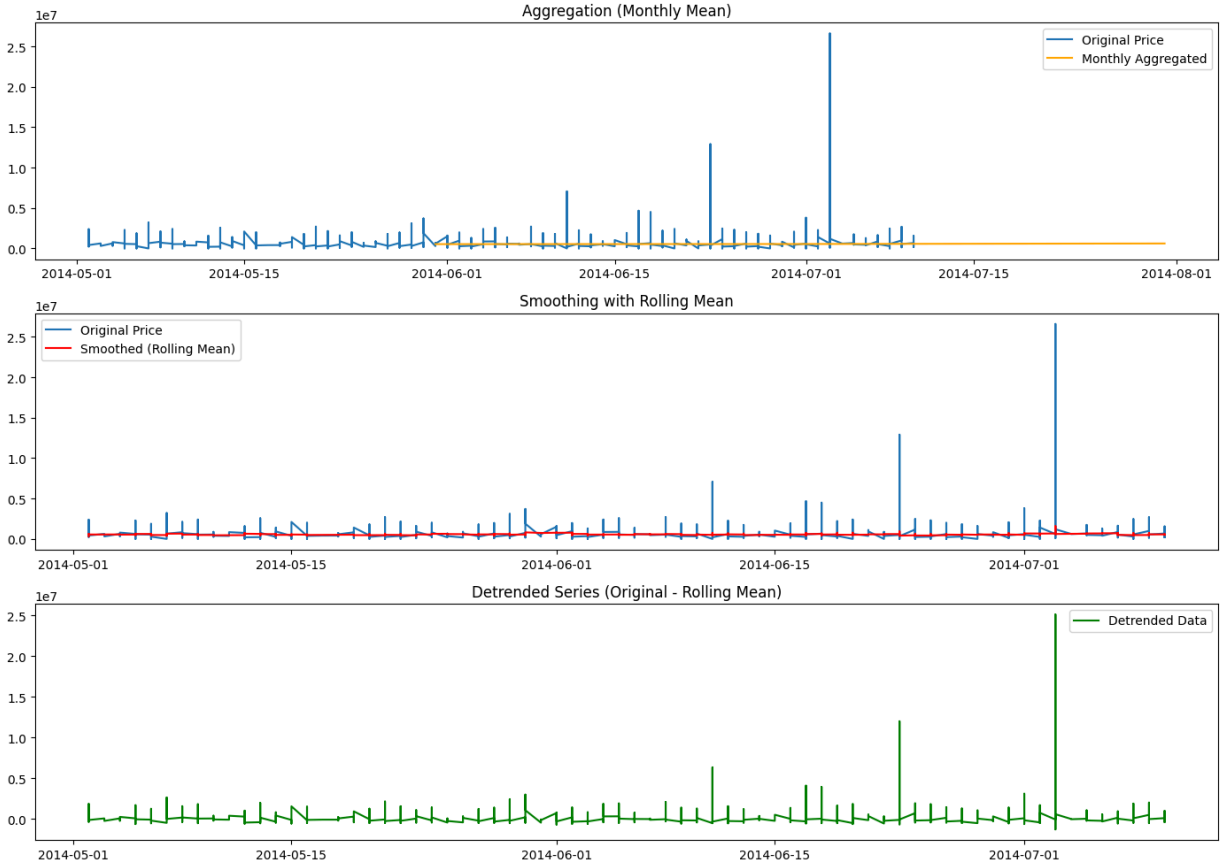
- Plot original vs aggregated
- Plot original vs smoothed
- Plot detrended data

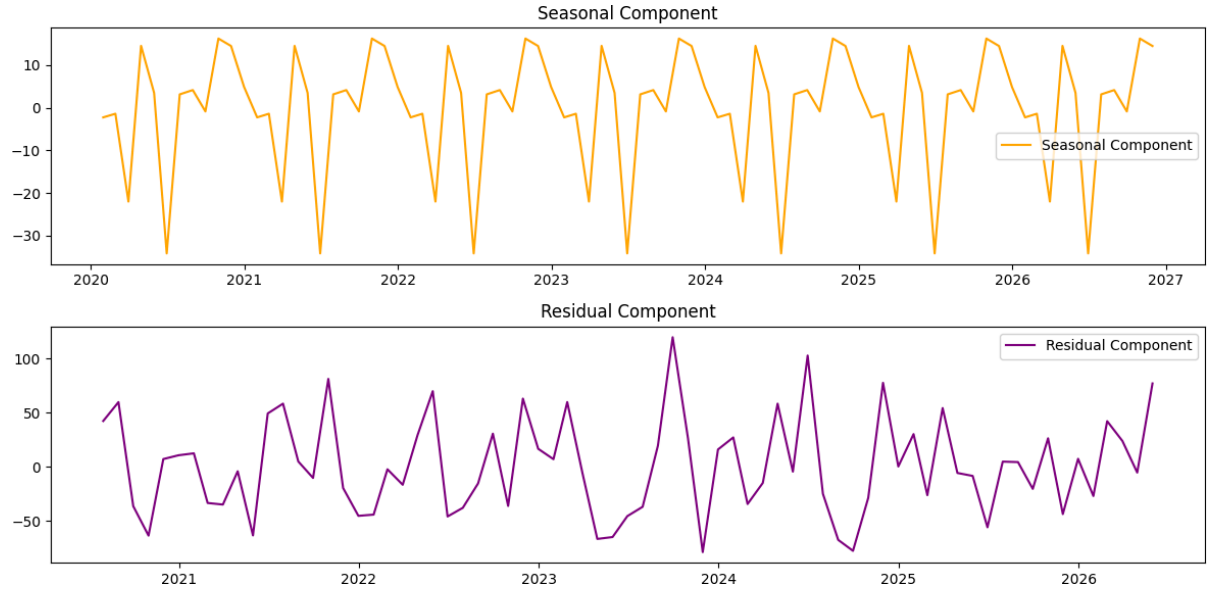
Code:

```
import pandas as pd
import matplotlib.pyplot as plt
```

```
\df = pd.read_csv("data.csv", parse_dates=['date'])
df.set_index('date', inplace=True)
df = df.sort_index()

df.fillna(method='ffill', inplace=True)
df.fillna(method='bfill', inplace=True)
df.dropna(inplace=True)
monthly = df['price'].resample('M').mean()
\rolling = df['price'].rolling(window=30, min_periods=1).mean()
# Detrend the data
detrended = df['price'] - rolling

plt.figure(figsize=(14, 10))

# Plot original and monthly trend
plt.subplot(3, 1, 1)
plt.plot(df['price'], label="Original Price")
plt.plot(monthly, label="Monthly Aggregated", color='orange')
plt.legend()
plt.title("Aggregation (Monthly Mean)")

# Plot original and rolling mean
plt.subplot(3, 1, 2)
plt.plot(df['price'], label="Original Price")
plt.plot(rolling, label="Smoothed (Rolling Mean)", color='red')
plt.legend()
plt.title("Smoothing with Rolling Mean")

# Plot detrended data
plt.subplot(3, 1, 3)
plt.plot(detrended, label="Detrended Data", color='green')
plt.legend()
plt.title("Detrended Series (Original - Rolling Mean)")

plt.tight_layout()
plt.show()
```

Output:


Aggregation (Monthly Mean)
1e7
Original Price
Monthly Aggregated
2.5
2.0
1.5
1.0
0.5
0.0
2014-05-01
2014-05-15
2014-06-01
2014-06-15
2014-07-01
2014-07-15
2014-08-01
Smoothing with Rolling Mean
1e7
Original Price
Smoothed (Rolling Mean)
2.5
2.0
1.5
1.0
0.5
0.0
2014-05-01
2014-05-15
2014-06-01
2014-06-15
2014-07-01
Detrended Series (Original - Rolling Mean)
1e7
Detrended Data
2.5
2.0
1.5
1.0
0.5
0.0
2014-05-01
2014-05-15
2014-06-01
2014-06-15
2014-07-01



Result:

Thus, the program to estimating & eliminating trend in time series data- aggregation, smoothing was done.