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IMPLEMENT PROGRAMS FOR DATA AGGREGATION, SMOOTHING, AND DETRENDING OF BITCOIN PRICE DATA

AIM:

To develop a Python program to perform data aggregation (from daily to weekly), smoothing (using a 7-day moving average), and detrending on Bitcoin price data.

ALGORITHM:

\*\*Step 1: Load and Prepare Data\*\*

Load the Bitcoin price dataset and ensure the 'Date' column is correctly formatted and set as the index. Select the 'Close' price and handle any missing values.

\*\*Step 2: Aggregate to Weekly Data\*\*

Resample the daily 'Close' price data to weekly frequency and calculate the mean for each week. Visualize the weekly aggregated data.

\*\*Step 3: Apply Smoothing\*\*

Calculate the 7-day moving average of the original daily 'Close' price. Visualize both the original daily price and the smoothed price.

\*\*Step 4: Detrend the Time Series\*\*

Subtract the 7-day moving average from the original daily 'Close' price to detrend the series. Visualize the detrended data with a horizontal line at zero.

PROCESS:

import pandas as pd

import numpy as np

import matplotlib.pyplot as plt

# Step 1: Load and Prepare Data

df = pd.read\_csv('BTC-USD.csv') # Replace with actual file path to your Bitcoin CSV

df['Date'] = pd.to\_datetime(df['Date'])

df.set\_index('Date', inplace=True)

df\_close = df[['Close']].copy()

df\_close['Close'] = df\_close['Close'].fillna(method='ffill').fillna(method='bfill').fillna(0)

# Step 2: Aggregate to Weekly Data

weekly\_data = df\_close['Close'].resample('W').mean()

# Plot aggregated weekly data

plt.figure(figsize=(12, 4))

weekly\_data.plot(title='Weekly Aggregated Bitcoin Close Price')

plt.xlabel('Date')

plt.ylabel('Close Price (USD)')

plt.show()

# Step 3: Apply Smoothing

df\_close['smoothed'] = df\_close['Close'].rolling(window=7, center=True).mean()

# Plot original and smoothed data

plt.figure(figsize=(12, 4))

plt.plot(df\_close['Close'], label='Original Daily Price')

plt.plot(df\_close['smoothed'], label='7-day Moving Average', color='red')

plt.title('Smoothed Bitcoin Close Price (7-day MA)')

plt.xlabel('Date')

plt.ylabel('Close Price (USD)')

plt.legend()

plt.show()

# Step 4: Detrend the Time Series

df\_close['detrended'] = df\_close['Close'] - df\_close['smoothed']

# Plot detrended data

plt.figure(figsize=(12, 4))

df\_close['detrended'].plot(title='Detrended Bitcoin Close Price')

plt.axhline(0, color='gray', linestyle='--')

plt.xlabel('Date')

plt.ylabel('Detrended Price (USD)')

plt.show()

OUTPUT:

(Three plots will be displayed as output, showing:

1. Weekly Aggregated Bitcoin Close Price

2. Original Daily Bitcoin Price vs. 7-day Moving Average

3. Detrended Bitcoin Close Price with a horizontal line at zero)

RESULT:

The program successfully loaded and prepared the Bitcoin price data. It then aggregated the daily 'Close' prices to weekly averages. A 7-day moving average was applied to smooth the daily data. Finally, the detrending process removed the smoothed trend from the original daily prices.