**Steps to Calculate RSI**

1. **Select the period**: Commonly, a 14-day period is used.
2. **Calculate the daily price changes**: Subtract the previous day's closing price from the current day's closing price.
3. **Separate the gains and losses**: Calculate the average gain and average loss over the selected period.
4. **Calculate the Relative Strength (RS)**: Divide the average gain by the average loss.
5. **Calculate the RSI using the RS**.

**Detailed Calculation Example**

Let's say we have the following closing prices for a stock over 15 days:

| **Day** | **Closing Price** |
| --- | --- |
| 1 | 44 |
| 2 | 46 |
| 3 | 43 |
| 4 | 45 |
| 5 | 47 |
| 6 | 46 |
| 7 | 48 |
| 8 | 49 |
| 9 | 50 |
| 10 | 48 |
| 11 | 47 |
| 12 | 49 |
| 13 | 51 |
| 14 | 52 |
| 15 | 53 |

**Step 1: Calculate Daily Price Changes**

Calculate the price changes between each day:

| **Day** | **Closing Price** | **Change** |
| --- | --- | --- |
| 1 | 44 | N/A |
| 2 | 46 | 2 |
| 3 | 43 | -3 |
| 4 | 45 | 2 |
| 5 | 47 | 2 |
| 6 | 46 | -1 |
| 7 | 48 | 2 |
| 8 | 49 | 1 |
| 9 | 50 | 1 |
| 10 | 48 | -2 |
| 11 | 47 | -1 |
| 12 | 49 | 2 |
| 13 | 51 | 2 |
| 14 | 52 | 1 |
| 15 | 53 | 1 |

**Step 2: Separate Gains and Losses**

Create two columns for gains and losses:

| **Day** | **Gain** | **Loss** |
| --- | --- | --- |
| 1 | 0 | 0 |
| 2 | 2 | 0 |
| 3 | 0 | 3 |
| 4 | 2 | 0 |
| 5 | 2 | 0 |
| 6 | 0 | 1 |
| 7 | 2 | 0 |
| 8 | 1 | 0 |
| 9 | 1 | 0 |
| 10 | 0 | 2 |
| 11 | 0 | 1 |
| 12 | 2 | 0 |
| 13 | 2 | 0 |
| 14 | 1 | 0 |
| 15 | 1 | 0 |

**Step 3: Calculate Average Gain and Average Loss**

For the 14-day RSI, calculate the average gain and average loss over the first 14 days (Days 2 to 15):

* **Average Gain**:

Average Gain=(2+0+2+2+0+2+1+1+2+2+1+1)14=1414=1\text{Average Gain} = \frac{(2 + 0 + 2 + 2 + 0 + 2 + 1 + 1 + 2 + 2 + 1 + 1)}{14} = \frac{14}{14} = 1Average Gain=14(2+0+2+2+0+2+1+1+2+2+1+1)​=1414​=1

* **Average Loss**:

Average Loss=(0+3+0+0+1+0+0+2+1+0+0)14=714=0.5\text{Average Loss} = \frac{(0 + 3 + 0 + 0 + 1 + 0 + 0 + 2 + 1 + 0 + 0)}{14} = \frac{7}{14} = 0.5Average Loss=14(0+3+0+0+1+0+0+2+1+0+0)​=147​=0.5

**Step 4: Calculate RS (Relative Strength)**

RS=Average GainAverage Loss=10.5=2RS = \frac{\text{Average Gain}}{\text{Average Loss}} = \frac{1}{0.5} = 2RS=Average LossAverage Gain​=0.51​=2

**Step 5: Calculate RSI**

Finally, substitute RSRSRS into the RSI formula:

RSI=100−(1001+RS)\text{RSI} = 100 - \left( \frac{100}{1 + RS} \right)RSI=100−(1+RS100​) RSI=100−(1001+2)=100−(1003)=100−33.33≈66.67\text{RSI} = 100 - \left( \frac{100}{1 + 2} \right) = 100 - \left( \frac{100}{3} \right) = 100 - 33.33 \approx 66.67RSI=100−(1+2100​)=100−(3100​)=100−33.33≈66.67

**Summary**

* The RSI calculated here is approximately **66.67**, indicating that the asset may be approaching overbought conditions, but it is not yet above the typical threshold of 70.

**Important Points:**

* The RSI is best used in conjunction with other indicators and analysis techniques.
* It helps traders to identify potential price reversals by recognizing overbought or oversold conditions in the market.

Please share the code so I can assist in defining the features you've engineered for predicting BTC prices using ML models.

4o

##### You said:

def calculate\_rsi(data, period=15): ''' Calculate Relative Strength Index for 15 days period ''' delta = data['close'].diff() gain = (delta.where(delta > 0, 0)).rolling(window=period).mean() loss = (-delta.where(delta < 0, 0)).rolling(window=period).mean() rs = gain / loss rsi = 100 - (100 / (1 + rs)) return rsi

###### ChatGPT said:

ChatGPT

Here’s the definition of the feature RSI (Relative Strength Index) based on the code:

**RSI (Relative Strength Index)**:  
The RSI is a momentum oscillator that measures the speed and change of price movements. It is calculated over a specified period, typically 14 or 15 days. The formula for RSI is:

RSI=100−1001+RSRSI = 100 - \frac{100}{1 + RS}RSI=100−1+RS100​

where:

* **RS** (Relative Strength) = Average Gain / Average Loss over the given period.
* **Gain**: Positive differences between consecutive closing prices.
* **Loss**: Negative differences between consecutive closing prices (converted to positive for calculation).

The RSI ranges between 0 and 100. Values above 70 typically indicate that an asset is overbought, while values below 30 suggest it is oversold. In this code, the RSI is calculated using a rolling window of 15 days.

This feature helps in identifying the strength or weakness of a trend in BTC prices.

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##### You said:

df['close\_lag1'] = df['close'].shift(1)

###### ChatGPT said:

ChatGPT

The feature created in this code is close\_lag1. Here’s the definition:

**close\_lag1**:  
This feature represents the closing price of Bitcoin on the previous day (or the previous time period, depending on the frequency of the data). By shifting the close column by 1, each row in close\_lag1 contains the closing price from the previous time step relative to the current row. This is a type of **lag feature**, often used in time series modeling to incorporate past values as predictors.

In the context of your prediction model, this feature helps in capturing the temporal relationship between consecutive closing prices, which can be important for forecasting future prices.

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##### You said:

df['stoch\_k'] = (df['close'] - df['low'].rolling(window=14).min()) / (df['high'].rolling(window=14).max() - df['low'].rolling(window=14).min()) \* 100

###### ChatGPT said:

ChatGPT

The feature created here is stoch\_k. Here's the definition:

**Stochastic Oscillator (%K)**:  
The Stochastic Oscillator is a momentum indicator that compares a specific closing price to a range of prices over a certain period (in this case, 14 days). The formula for %K is:

stoch\_k=(Close−LowestLow)(HighestHigh−LowestLow)×100stoch\\_k = \frac{(Close - Lowest Low)}{(Highest High - Lowest Low)} \times 100stoch\_k=(HighestHigh−LowestLow)(Close−LowestLow)​×100

Where:

* **Close**: The current closing price of Bitcoin.
* **Lowest Low**: The lowest price over the past 14 periods (rolling window of 14).
* **Highest High**: The highest price over the past 14 periods.

This oscillator is used to identify potential overbought or oversold conditions. The values range from 0 to 100:

* A value above 80 generally indicates that the asset is overbought.
* A value below 20 suggests the asset is oversold.

In this case, stoch\_k measures the relative position of the current price within the 14-day range of high and low prices, which helps capture the market momentum for predicting future price movements.

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##### You said:

df['EMA12'] = df['close'].ewm(span=12, adjust=False).mean() df['EMA26'] = df['close'].ewm(span=26, adjust=False).mean() df['MACD'] = df['EMA12'] - df['EMA26'] df['MACD\_Signal'] = df['MACD'].ewm(span=9, adjust=False).mean()

###### ChatGPT said:

ChatGPT

The code creates several features related to the **MACD (Moving Average Convergence Divergence)** indicator. Here's a breakdown of the features:

1. **EMA12 (12-period Exponential Moving Average)**:  
   This is the exponential moving average of the closing price over the past 12 periods (days, or whatever the frequency of your data is). The EMA gives more weight to recent prices, making it more responsive to current price changes compared to a simple moving average.
2. **EMA26 (26-period Exponential Moving Average)**:  
   Similar to EMA12, this is the exponential moving average of the closing price over the past 26 periods. It smooths the price data over a longer period, making it less sensitive to recent price changes.
3. **MACD (Moving Average Convergence Divergence)**:  
   The MACD is calculated as the difference between the 12-period EMA and the 26-period EMA:

MACD=EMA12−EMA26MACD = EMA12 - EMA26MACD=EMA12−EMA26

The MACD indicates the momentum of the market by comparing short-term and long-term price trends. A positive MACD suggests upward momentum, while a negative MACD indicates downward momentum.

1. **MACD Signal Line**:  
   This is a 9-period EMA of the MACD itself, used as a signal line to identify potential buy or sell signals:

MACD\_Signal=EMA(MACD,9)MACD\\_Signal = EMA(MACD, 9)MACD\_Signal=EMA(MACD,9)

When the MACD crosses above the signal line, it generates a potential **buy signal** (bullish), and when it crosses below the signal line, it generates a potential **sell signal** (bearish).

### Summary:

* **EMA12** and **EMA26**: Short-term and long-term trend indicators.
* **MACD**: The difference between the short-term (EMA12) and long-term (EMA26) moving averages, indicating trend strength and momentum.
* **MACD Signal Line**: A smoothed version of the MACD, used to confirm trend reversals or continuations.

These features are widely used in trading strategies to predict price movements and identify trend reversals.