Time Series (Rolling & Expanding)

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Moving Average

A technique used to smooth out short-term fluctuations in a time series and to highlight longer-term trends or cycles.

Moving Average

By replacing raw data points with their averages over a specified windows, a rolling average diminishes random variations makint it easier to understand data.

Key Points:

Window/Lookback Period:

The number of consecutive data points used to compute the average

Key Points:

Overlapping Windows:

As we move forward in time, the window “rolls,” and the average is recalculated.

Key Points:

Usage:

1. Smoothing noise (stock prices, financial data)
2. Trend analysis (sensor data)
3. Forecasting and anomaly detection (economics, sales, etc.)

Equation:

For a time series $X = \{x_1, x_2 \ldots x_t\}$ and a chosen window size n, the simple moving average at time t $(denoted\ SMA_t)$ is:

$$\mathrm{SMA}_t = \frac{1}{n}\sum_{i=0}^{n-1} x_{t-i}$$

Where $x_{t\ -i}$ is the value of the series at index $t\ - i$.
The average is only defined it $t \geq$ n (i.e., enough points exist)

Expanding Window

An expanding window in time series analysis progressively increasing the size of the window from the start of the series up to the current point in time

Expanding Window

It accumulates all available data from the beginning (or from an initial index) up to the current point.

Key Benefits:

1. Includes all prior observations
2. Shows long-term trend
3. Common in cumulative performance

Cognate/Professional Electives

Aspect	Rolling Window	Expanding Window
Window Size	Fixed or sliding (last n points)	Grows from start point to the current index
Data Usage	Only uses most recent *n* points are available	Use all observations since the beginning (or min period)
Edge Effects	Not computed until the first n points are available	Starts as soon as minimum data is available, expanding
Example	7-day moving average on daily data	Cumulative average from day 1 to the current day

[Code Demo]

Thank you very much for listening.