

HW-Topic-8

Data Acquisition, Modeling and Analysis: Big Data Analytics

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Autoregressive (AR) Models

WHAT IS IT?

- It's a way to **predict the future of a time series**
- The main idea is that **value depends only on its own past values**.
- The model learns the **relationship** a variable has with its history.

ADVANTAGES

- Simplicity and Speed
- Effective for **Short-Term** Data
- Foundation for Forecasting

DISADVANTAGES

- Sensitive to model order misspecification.
- Requires stationarity
- Assumes linear relationships only.

APPLICATIONS

- **Finance:** Stock or FX forecasting
- **Industry:** Predictive maintenance
- **Healthcare:** ECG/EEG analysis
- **Climate:** Weather prediction
- **Economics:** Trend modeling

THE AR EQUATION

$$X_t = c + \phi_1 X_{t-1} + \phi_2 X_{t-2} + \dots + \phi_p X_{t-p} + \varepsilon_t$$

Term	Description
X_t	The value of the time series at the current time, t (the predicted value).
c	A constant term (intercept).
ϕ_1, \dots, ϕ_p	The autoregressive coefficients (model parameters) that measure the influence of each past value.
X_{t-1}, \dots, X_{t-p}	The past observations, known as lagged values .
ε_t	The white noise or random error term at time t . (Assumed to be independent and identically distributed, with a mean of zero and constant variance).