

Time Series

Introduction & Classical Decomposition

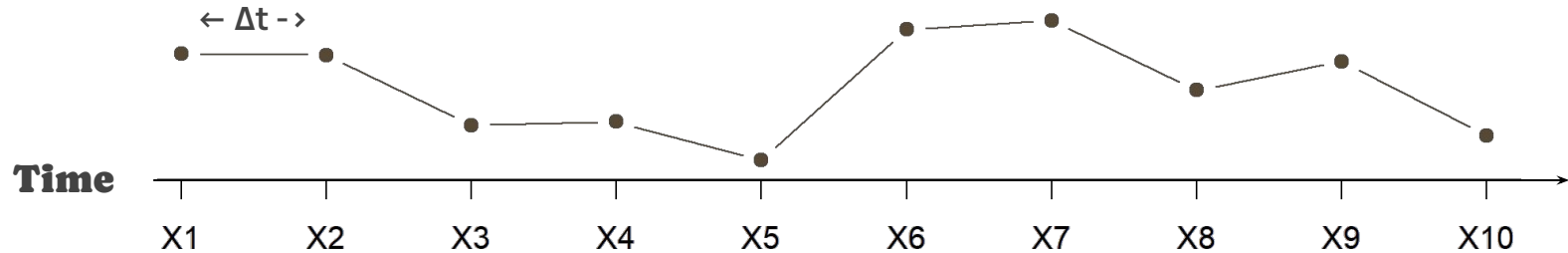
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Discrete Time Series Analysis

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What is a Time Series ?

- 🕒 Sequence of observations (or Random Variables) indexed by time
- 🕒 Assume regular time intervals: $\Delta t = 1$, unless stated otherwise



Capital letters = Random Variables (RVs)

Lowercase letters = Observations

X_1, X_2, \dots

x_1, x_2, \dots

Formats we will encounter

- 1) Infinite & Random X_t $t \in \mathbb{Z} = \{\dots, -1, 0, 1, \dots\}$
- 2) Finite & Random X_t $t \in T_N = \{t_1, t_2, \dots, t_N\}$
- 3) Finite & Observed x_t $t \in T_N = \{1, 2, \dots, N\}$

Notation Skye Likes ♥ $\{X_t\}_{t \in T_N}$

$\{X_t\}$

Classical Decomposition (★)

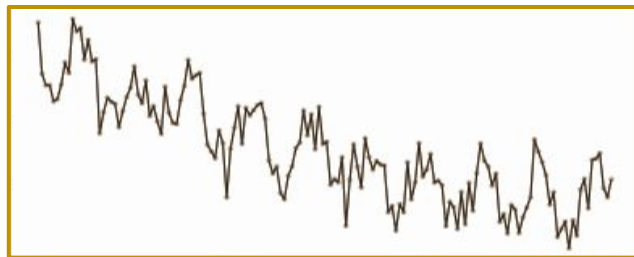
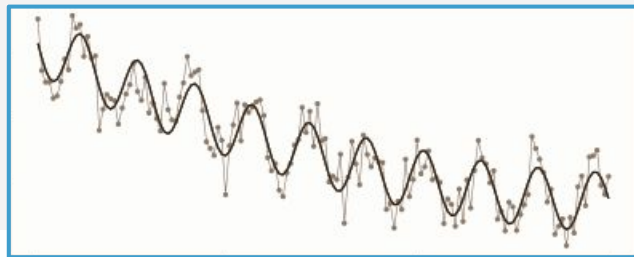
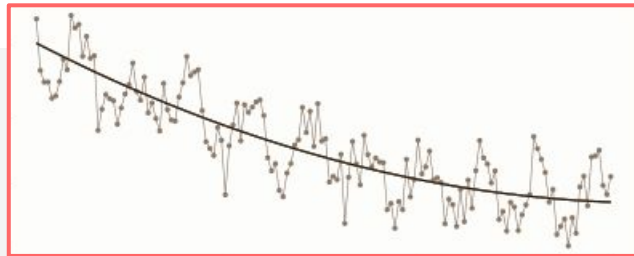
Deterministic trend (linear, quadratic)

Determ. seasonal component

Random process

Zero-mean Gaussian

$$X_t = m_t + s_t + Y_t \quad (\star)$$



- ⌚ Given a period d , assume $\sum_{t=1}^d s_t = 0$
- ⌚ Can have multiple s_t with different periods

What do we tell the simple creature?