Time Series

Introduction & Classical Decomposition

STAT 464 / 864 | Fall 2024
Discrete Time Series Analysis
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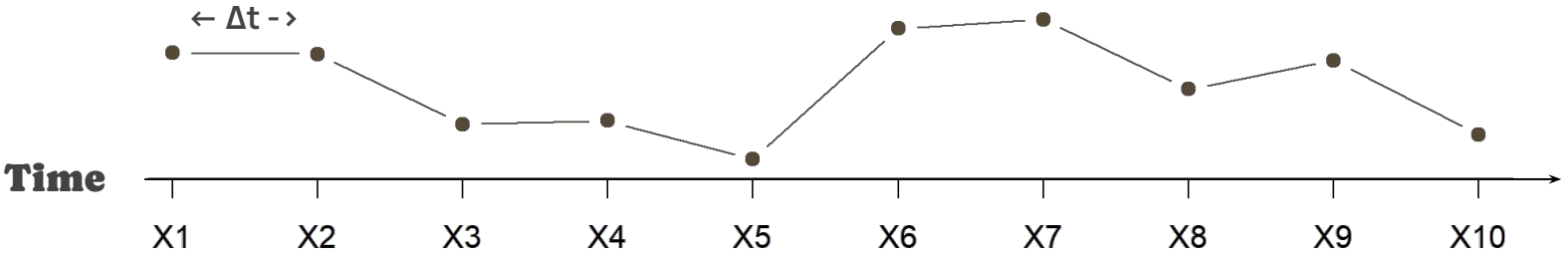
What is a Time Series ?

- Sequence of observations (or Random Variables) indexed by time
- Assume regular time intervals: **Δt = 1,** unless stated otherwise



Capital letters = Random Variables (RVs) $X_1, X_2, \ldots$

Lowercase letters = Observations $x_1, x_2, \ldots$

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 ❤ $\{X_t\}_{t \in T_N}$

{Xt}

Classical Decomposition (⋆)

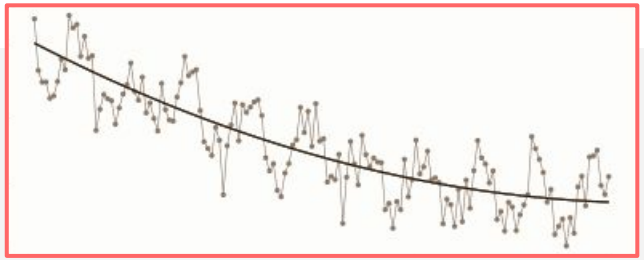
Deterministic **trend** (linear, quadratic)

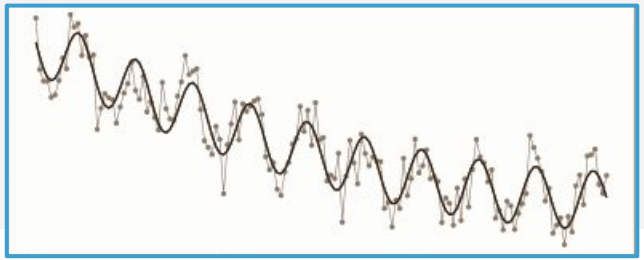
Determ. **seasonal** component

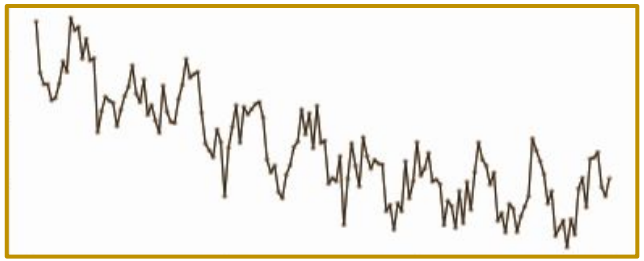
Random process

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