

# 1 Linear Regression

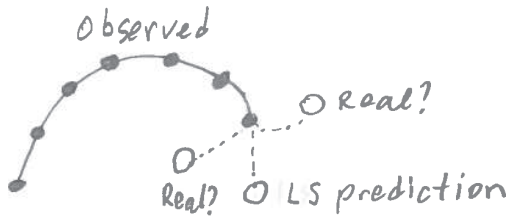


Figure 1: WLAN client motion.

§ **Modeling is a decision problem.** We will consider 3 examples:

- Modeling WLAN client position and predicting next location.
- Modeling a mechanical S-N curve.
- Modeling the economic Phillips curve.<sup>1</sup>

§ **WLAN client tracking and prediction:**

§ Challenge: Two foci of uncertainty:

- Randomness:
  - Noisy data (statistics).
- Info-gaps:
  - Changing plans and intentions of client.
  - Interaction with other people.
  - Environmental variability.

§ Questions:

- How to use empirical data to model uncertain past motion?
- Is optimal estimation (e.g. least-squares) a good strategy for predicting future position?
- Can we do better?
- How to manage both statistical and info-gap uncertainty?
- How to evaluate estimate vis a vis info-gaps?

<sup>1</sup>Source: Yakov Ben-Haim, 2010, *Info-Gap Economics: An Operational Introduction*, Palgrave-Macmillan.

§ Mechanical S-N curve:

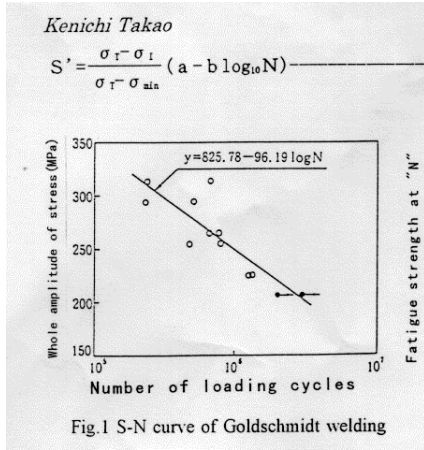


Figure 2: S-N curves.

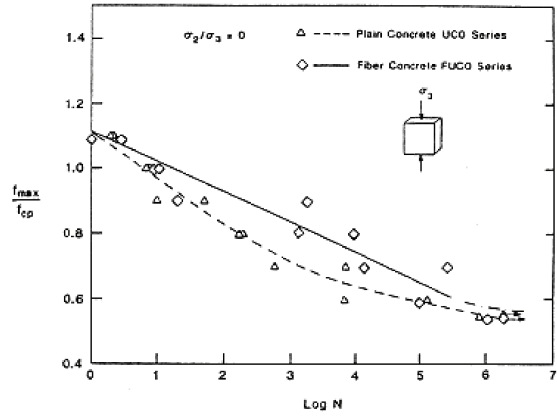


Figure 3: S-N curves.

§ Challenge: Two foci of uncertainty:

- Randomness:
  - Noisy data (statistics).
- Info-gaps:
  - Changing fundamentals.
  - Material variability.
  - Environmental variability.

§ Questions:

- How to use empirical data to model uncertain material?
- Is optimal estimation (e.g. least-squares) a good strategy?
- Can we do better?
- How to manage both statistical and info-gap uncertainty?
- How to evaluate estimate vis a vis info-gaps?

§ Economic Phillips curve:

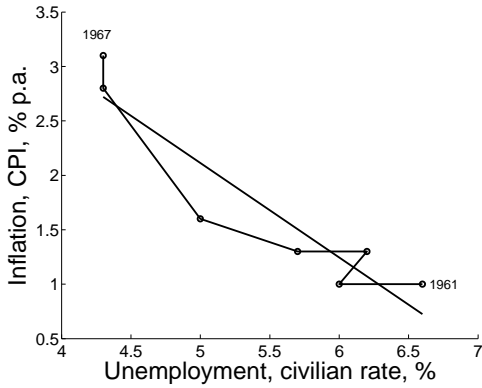


Figure 4: Inflation vs. unemployment in the US, 1961–1967.



Figure 5: Inflation vs. unemployment in the US, 1961–1993.

§ Inflation vs. unemployment, US, '61-'67:

- Approximately linear.
- Slope  $\approx -0.87$  %CPI/%unemployment.

§ Slopes in other periods:

- '61-'67:  $-0.87$
- '80-'83:  $-3.34$
- '85-'93:  $-1.08$
- '70-'78: ???

§ Challenge: Two foci of uncertainty:

- Randomness:
  - Noisy data (statistics).
- Info-gaps:
  - Changing fundamentals.
  - Data revision.

§ Questions:

- How to use historical data to model the future?
- Is optimal estimation (e.g. least-squares) a good strategy?
- Can we do better?
- How to manage both statistical and info-gap uncertainty?
- How to evaluate estimate vis a vis info-gaps?