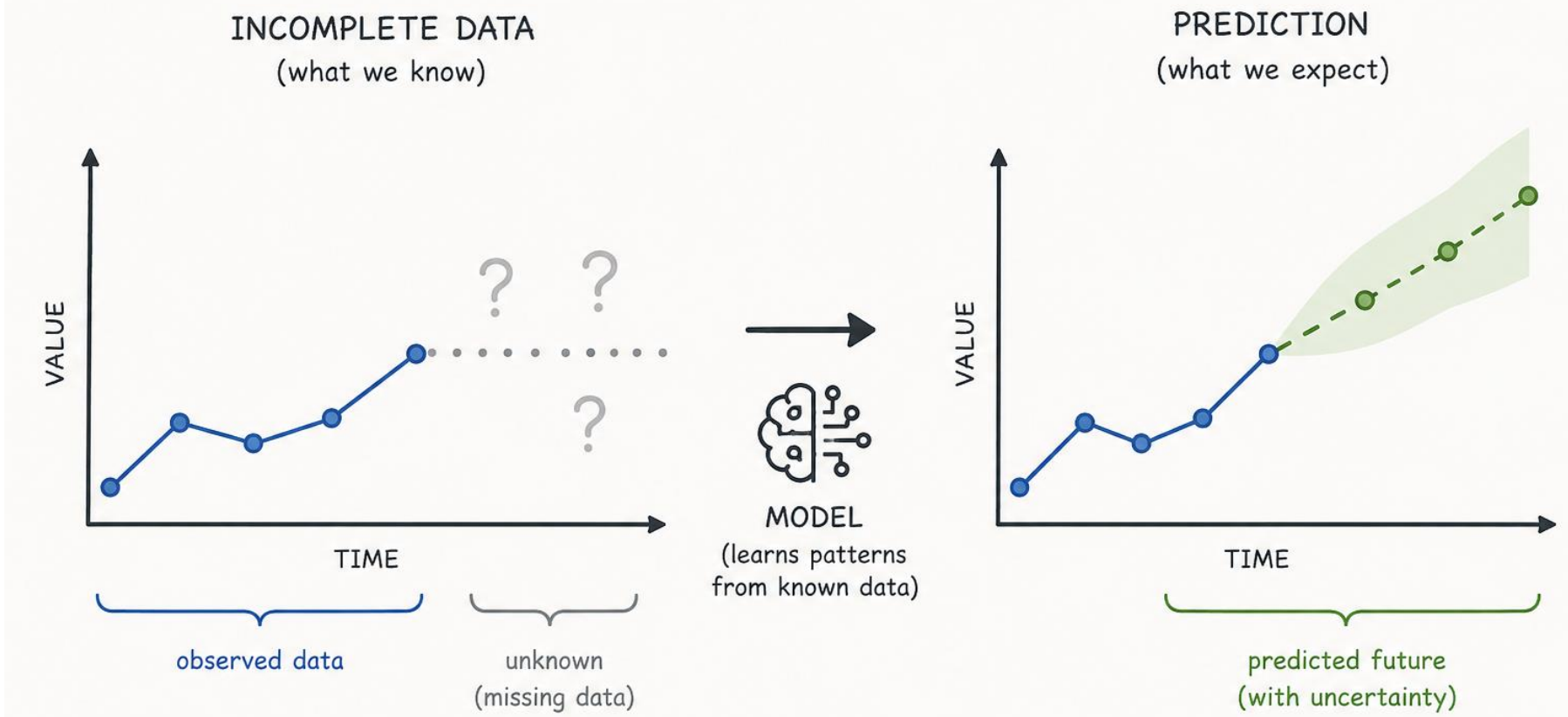
IAN MARSH

A Data-Driven Methodology for Forecasting Long-Term Mission Profiles of Household Appliances



Using patterns from what we know,
the model predicts what comes next.

RI.
SE

RI.
SE

A

Design

For life.

Inherent Data Challenges

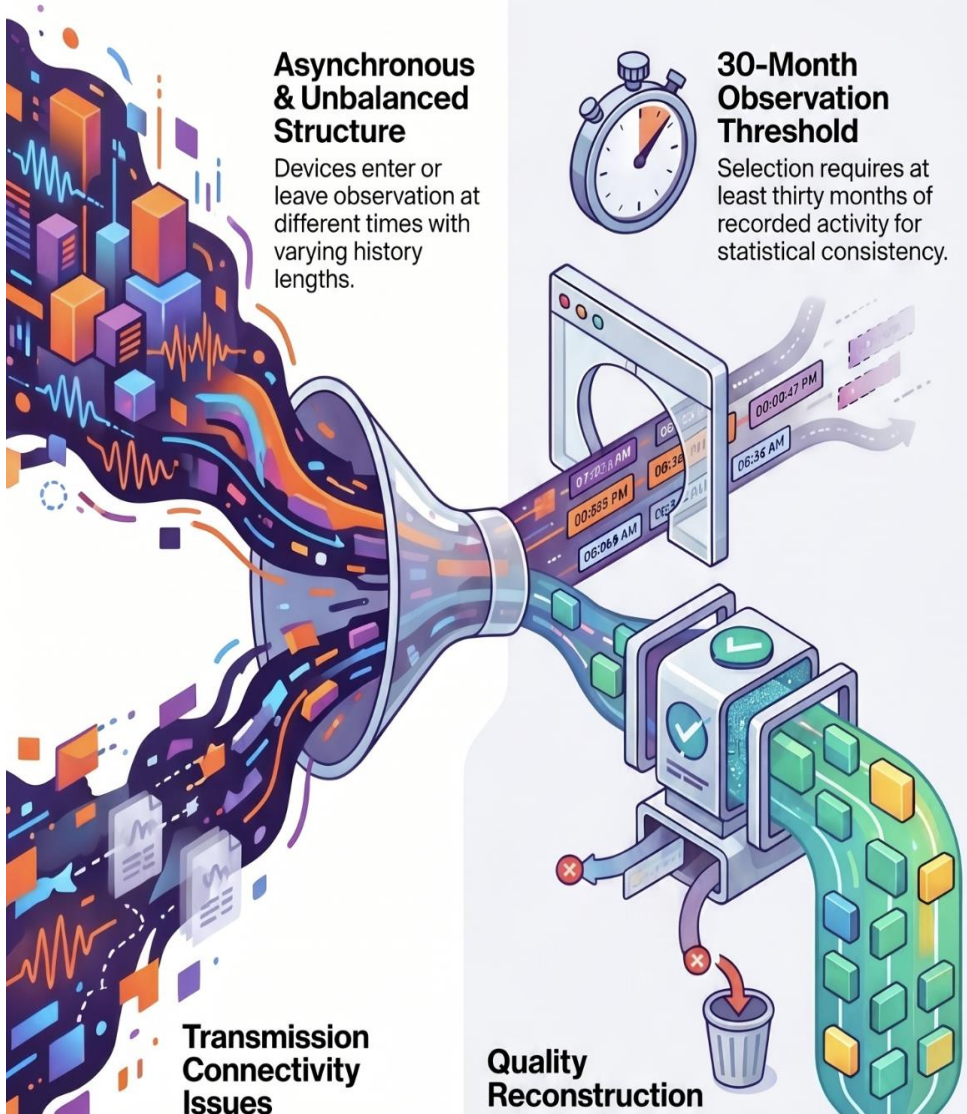
The Filtering Process

Asynchronous & Unbalanced Structure

Devices enter or leave observation at different times with varying history lengths.

30-Month Observation Threshold

Selection requires at least thirty months of recorded activity for statistical consistency.



Transmission Connectivity Issues

Quality Reconstruction

RI.SE

CYCLES

COUNT

RI.
SE

DATA

QUALITY

Connectivity

30 MONTHS

Data

10 year

$$S_{i,T} = \sum_{m=1}^{T} X_{i,m} \qquad (1)$$

$$X_{i,m} \sim \text{Gamma}(k_m, \theta_m \cdot Z_i) \qquad (2)$$

$$\mathbb{E}[X_{i,m}] = k_m \cdot \theta_m \cdot Z_i \qquad (3)$$

$$\hat{k}_m = \frac{\mu_m^2}{\sigma_m^2}, \hat{\theta}_m = \frac{\sigma_m^2}{\mu_m} \qquad (4)$$

$$Z_i^{(H)} = \frac{\sum_{m=1}^{H} X_{i,m}}{\sum_{m=1}^{H} \mathbb{E}[X_m]} \qquad (5)$$

$$\mathbb{E}[Z_i] \approx 1 \qquad (6)$$

$$\text{CV}(Z) = \frac{\sigma_Z}{\mu_Z} \qquad (7)$$

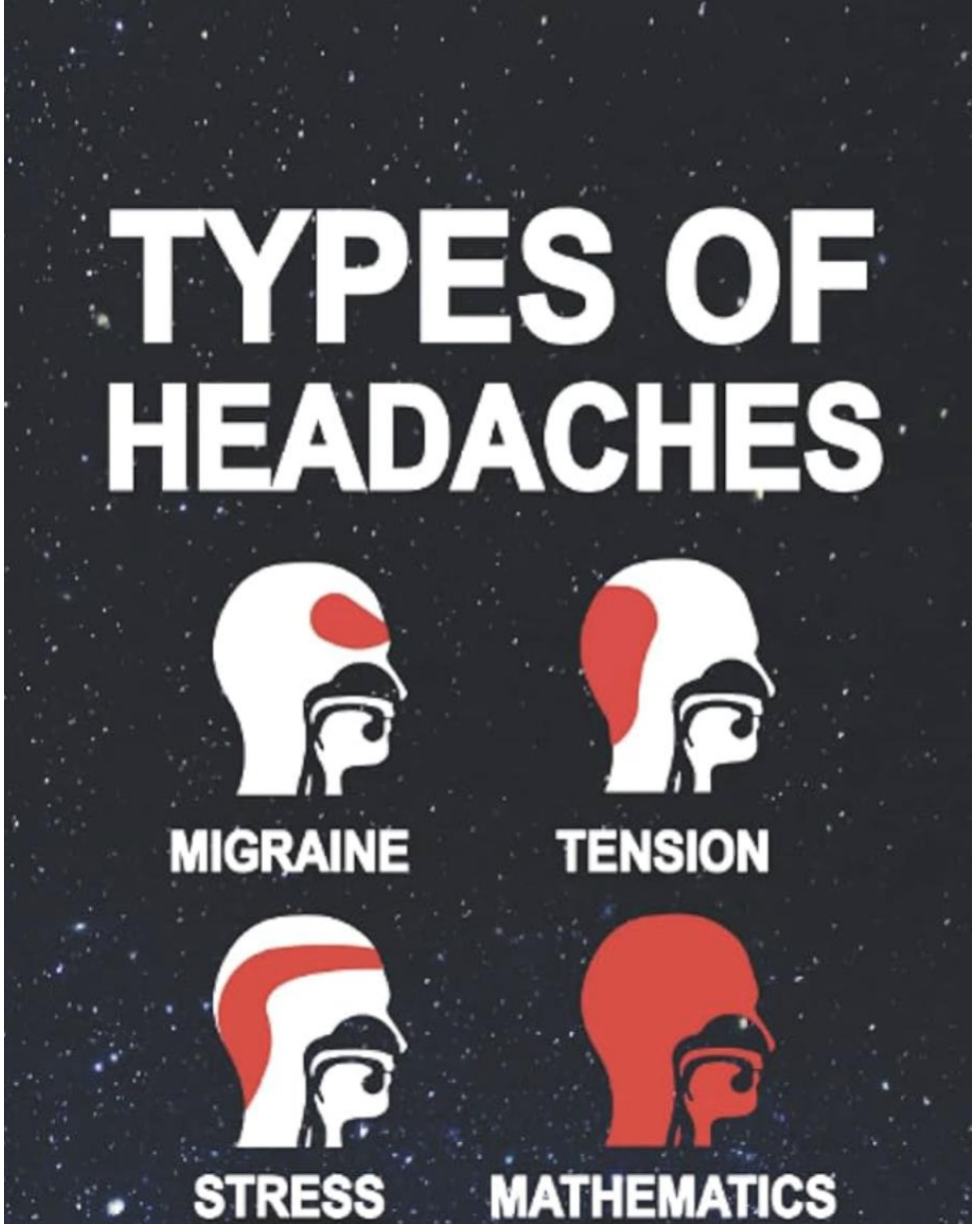
$$S_T = \sum_{m=1}^{T} X_m \qquad (8)$$

$$\text{Var}(S_T) = \mathbb{E}[\text{Var}(S_T \mid Z)] + \text{Var}(\mathbb{E}[S_T \mid Z]) \qquad (9)$$

$$\mathbb{E}[S_T \mid Z] = Z \cdot \sum_{m=1}^{T} \mu_m \qquad (10)$$

Cut the cp !**

RI.
SE


TYPES OF HEADACHES
MIGRAINE
TENSION
STRESS
MATHEMATICS