The progress of applying covariance estimation methods on Speedy model

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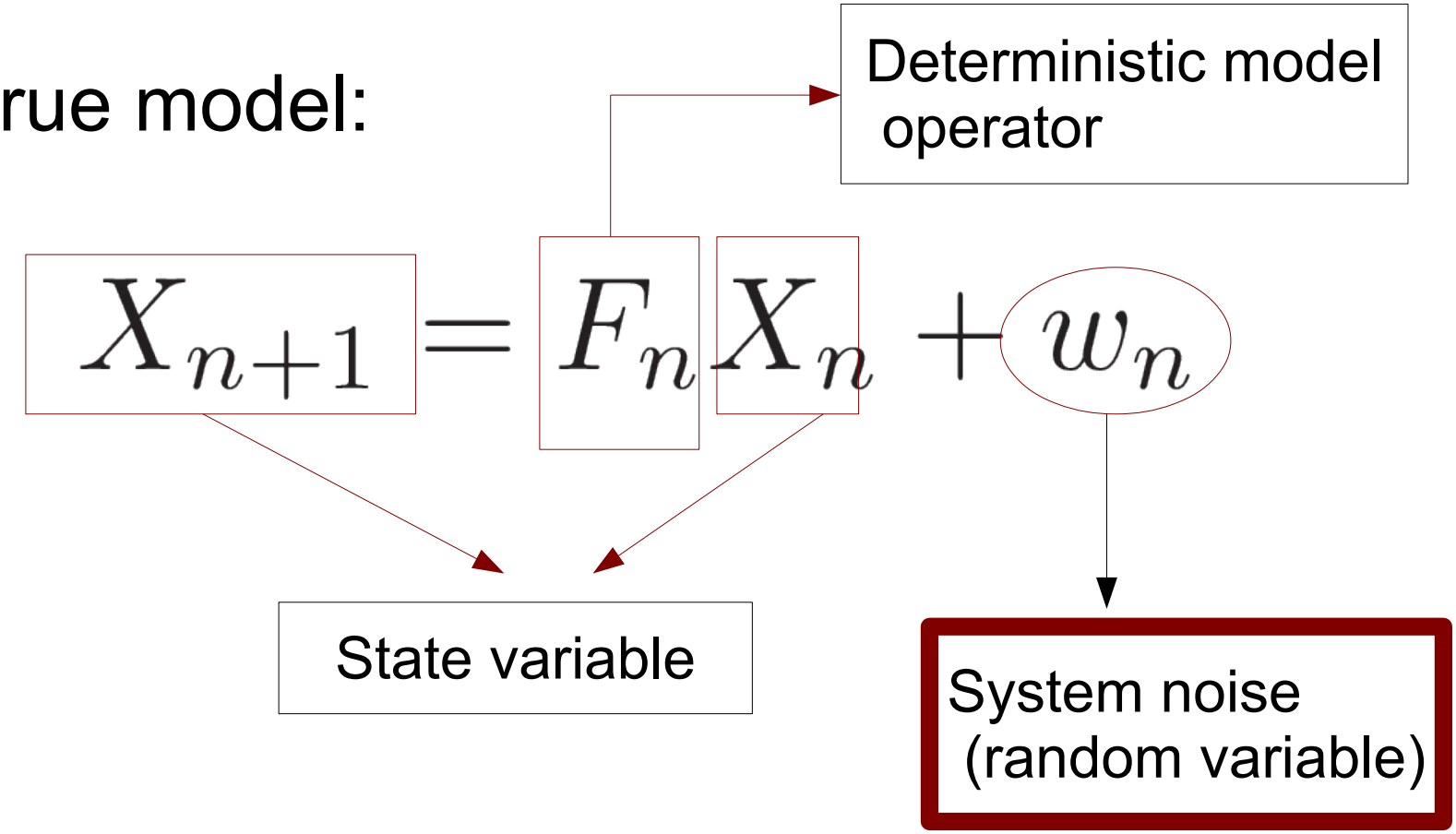
Outline

- An overview of covariance estimation methods
- The major challenge of applying these methods

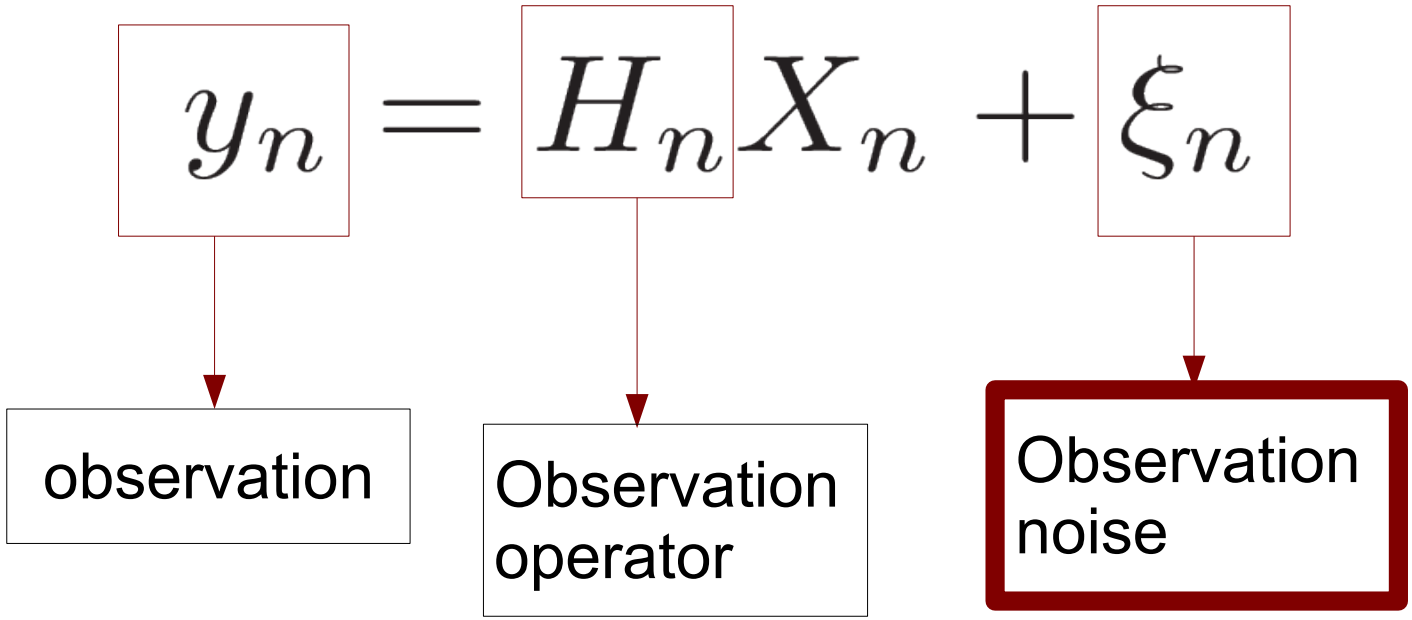
Mathematical formulation

- True model:



Mathematical formulation

- Observational model:



Covariance estimation methods

- Mehra (1970s)
- Belanger (1970s)
- Berry & Sauer (2014)
- Zhen & Harlim (2015)
- Etc.

The common idea within these methods

- Construct a new set of “observations” for Q and R from the existing observations:

$$\mathcal{Y}_{n,l} = y_n y_{n-l}^\top$$

Observation at time t_n

Observation at time t_{n-l}

The common idea within these methods

Construct a linear relation between

- $$\mathbb{E}[\mathcal{Y}_{n,l}] = \mathcal{H}_{n,l}(Q, R)$$

linear

The main challenge and possible solution

- Challenge : When applied to non-linear problems, these methods require relatively large ensemble size.
- Solution(?) : reduce the number of parameters in Q and R to O(1).
- Progress: still debugging the code.