

# High Frequency Road Sensor Data for Official Statistics

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Statistics  
Netherlands

# Road sensors

## Road sensor data

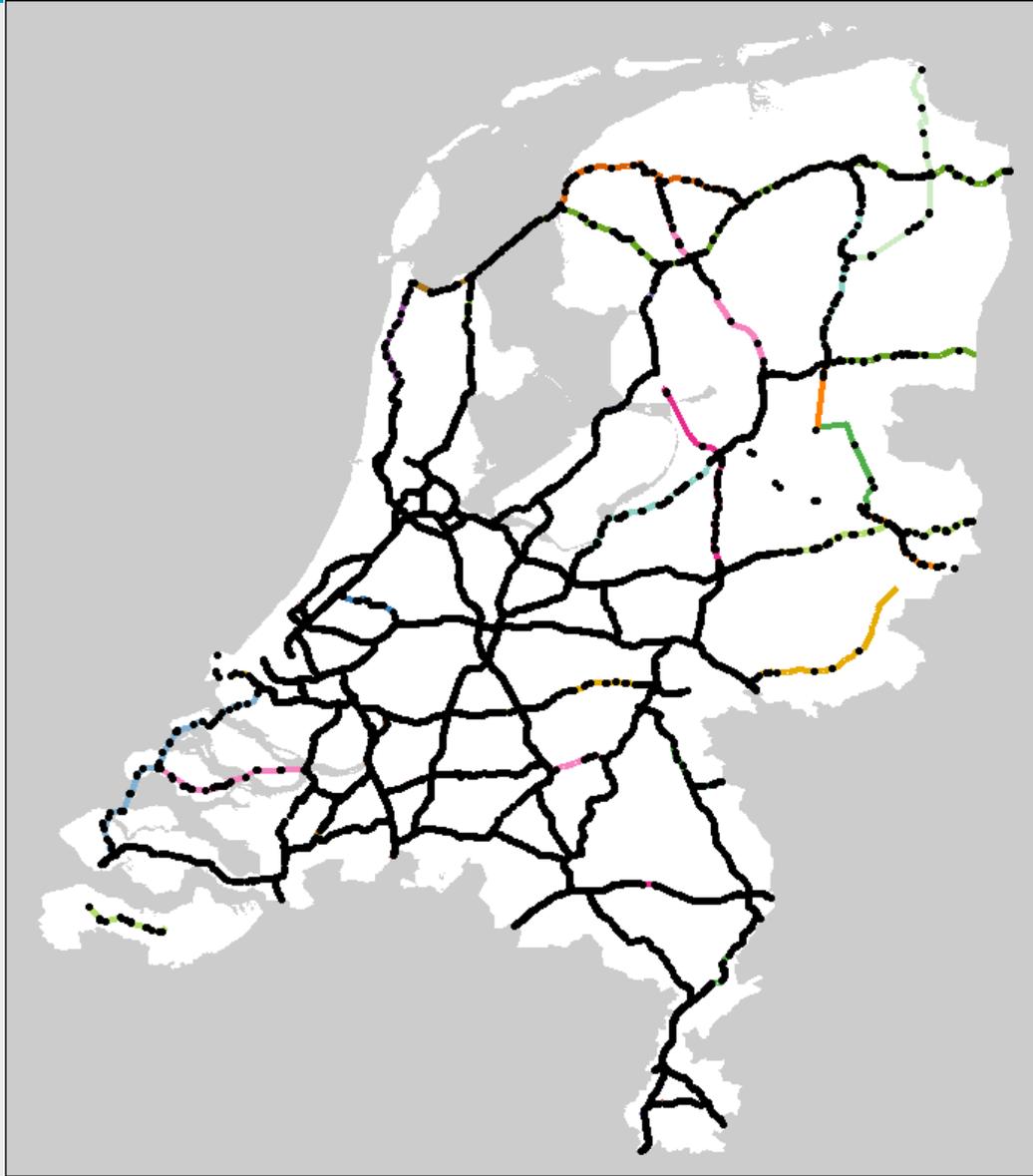
- Passing vehicle counts for each minute (24/7) at about 60.000 sensors in the Netherlands
- Types of sensors:
  - Induction loop
  - Camera
  - Bluetooth
- Length categories (e.g. small, medium, long vehicles)
- Large volume: approx. 230 mln records/day



# Dutch highways



# Dutch highways with road sensors



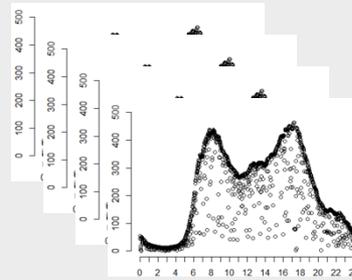
# Final Process



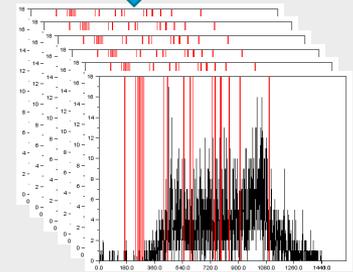
Frame



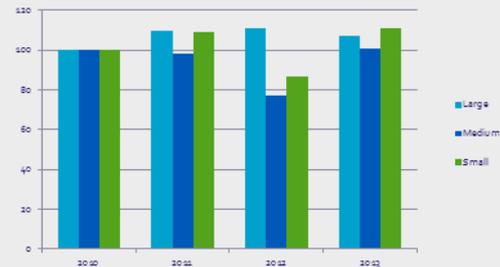
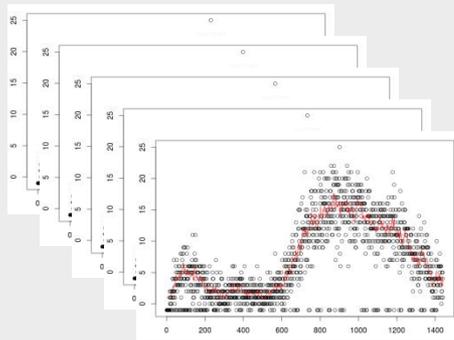
Aggregate



Transform & Select

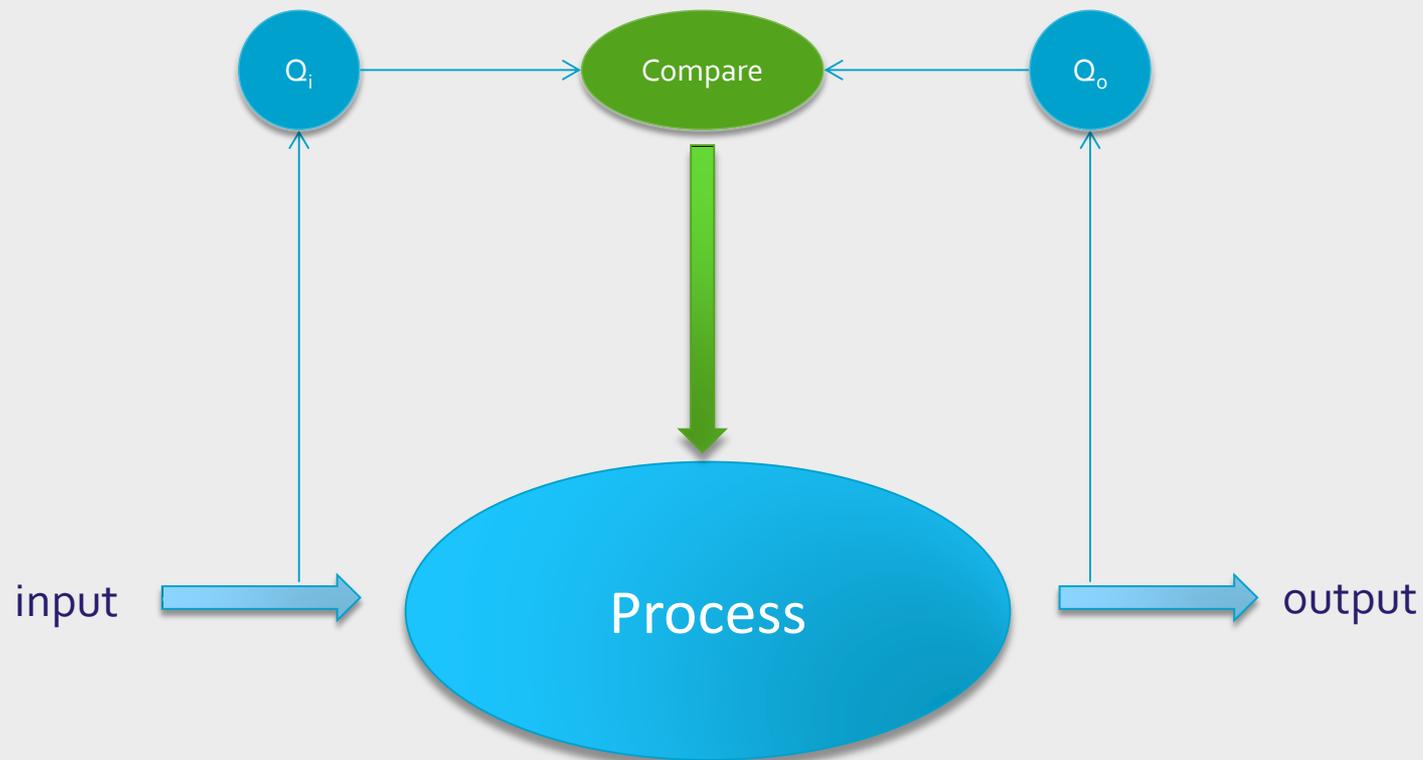


Clean

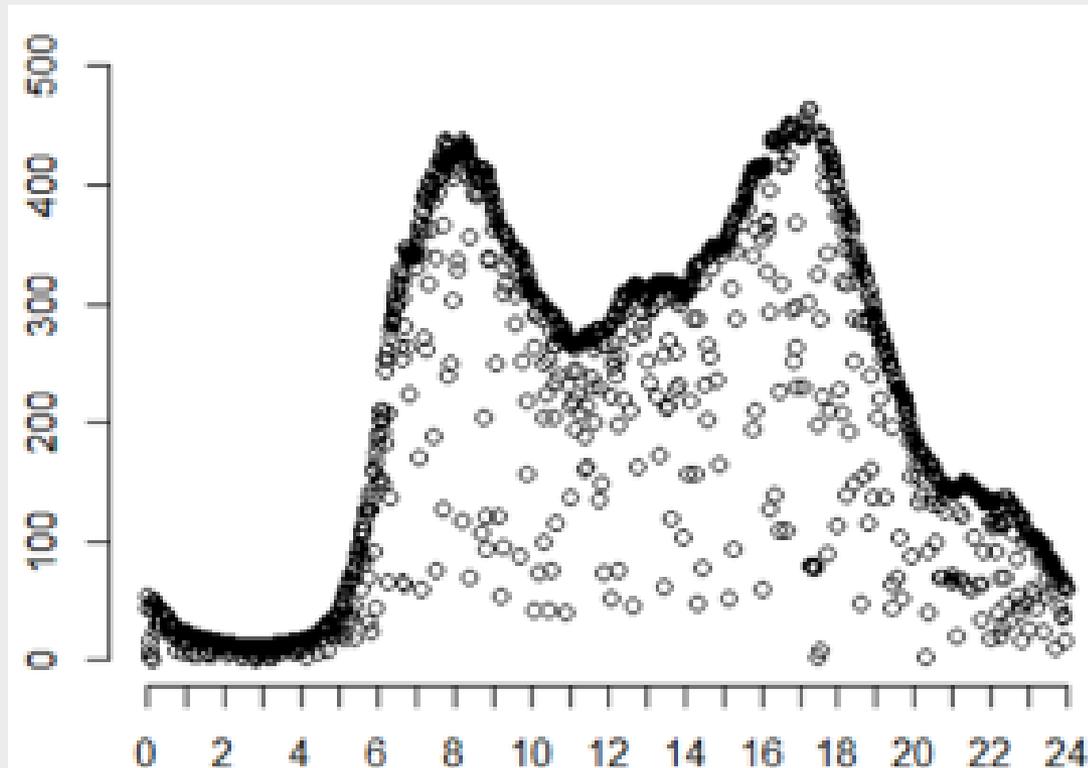


# Big Data Processes

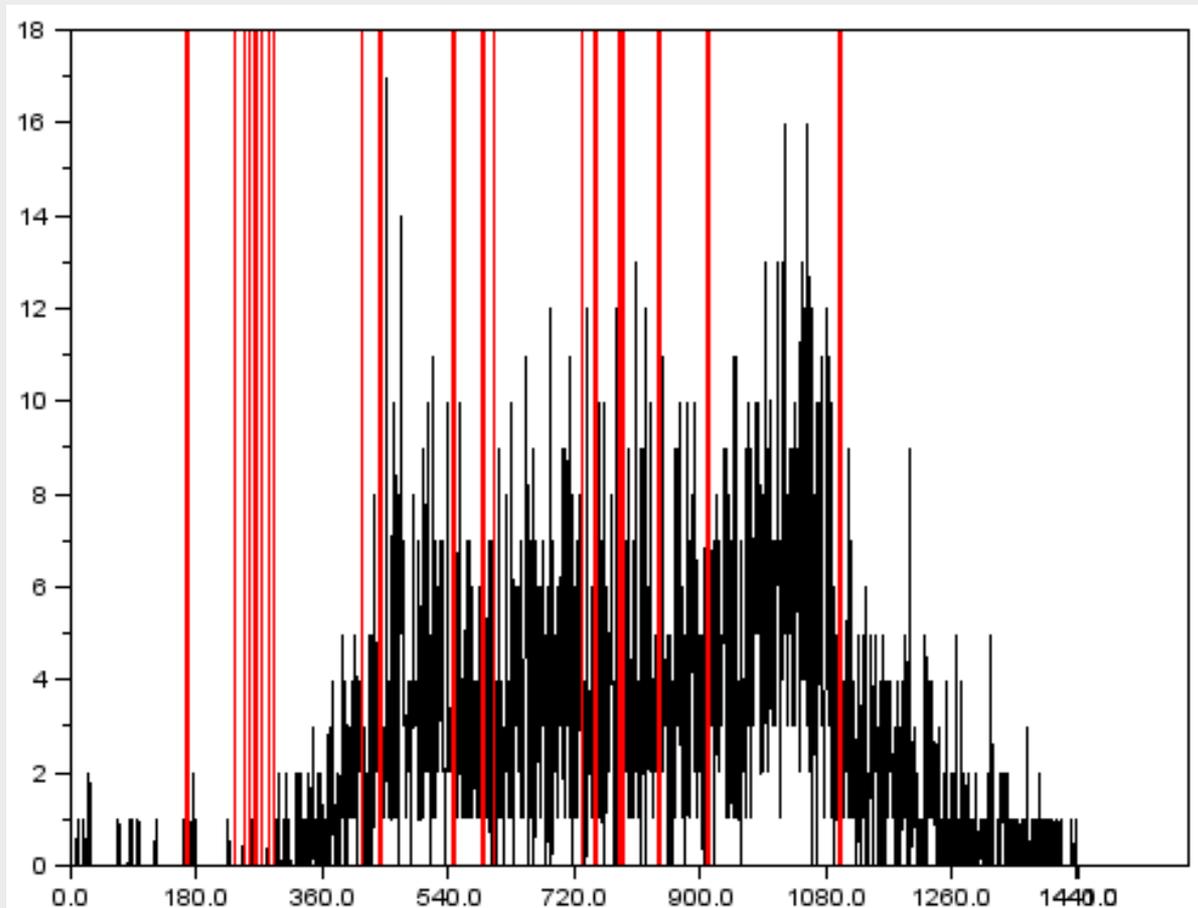
## Quality feedback loop



# Low quality of data

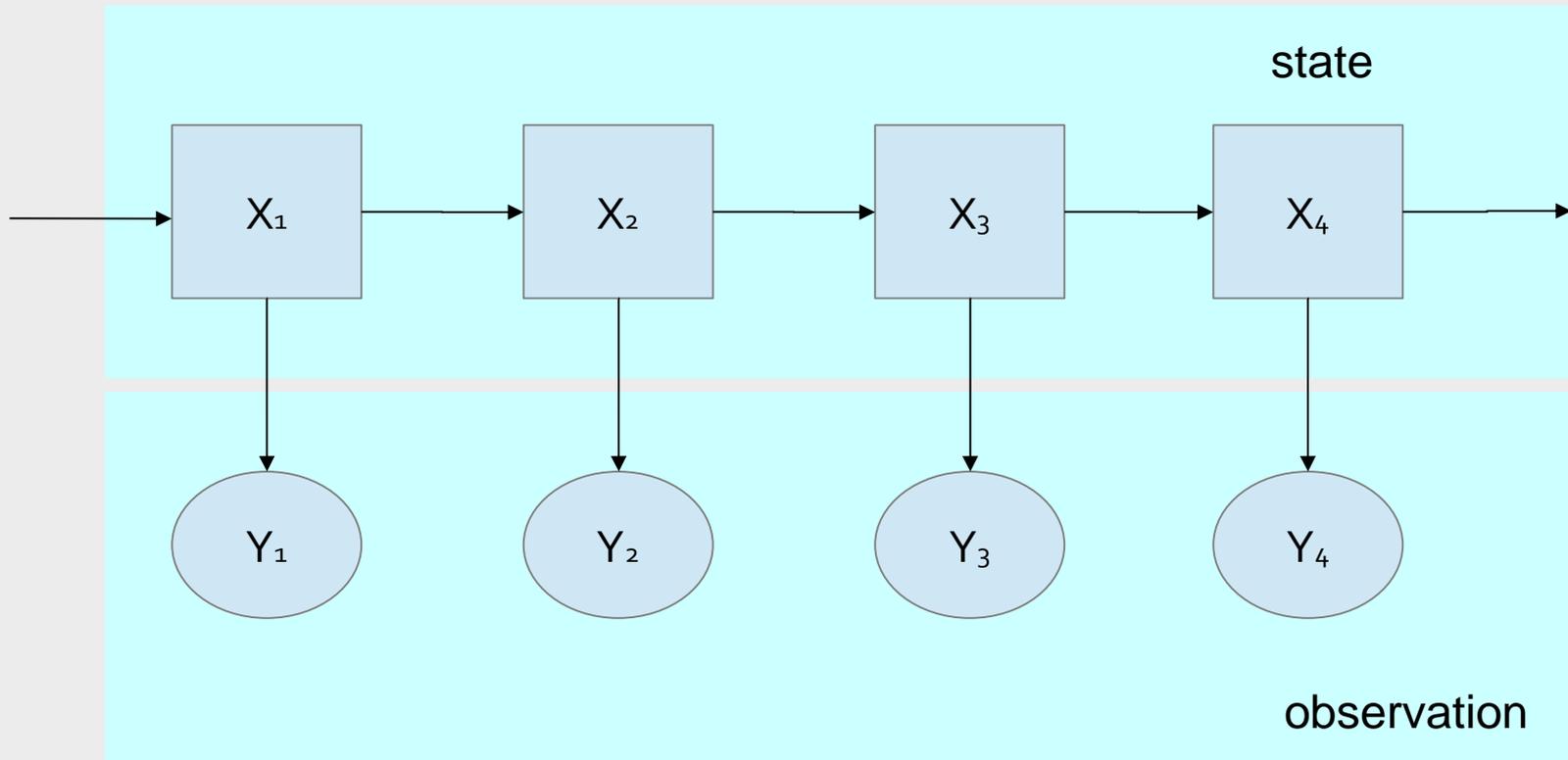


# Quality of the Data



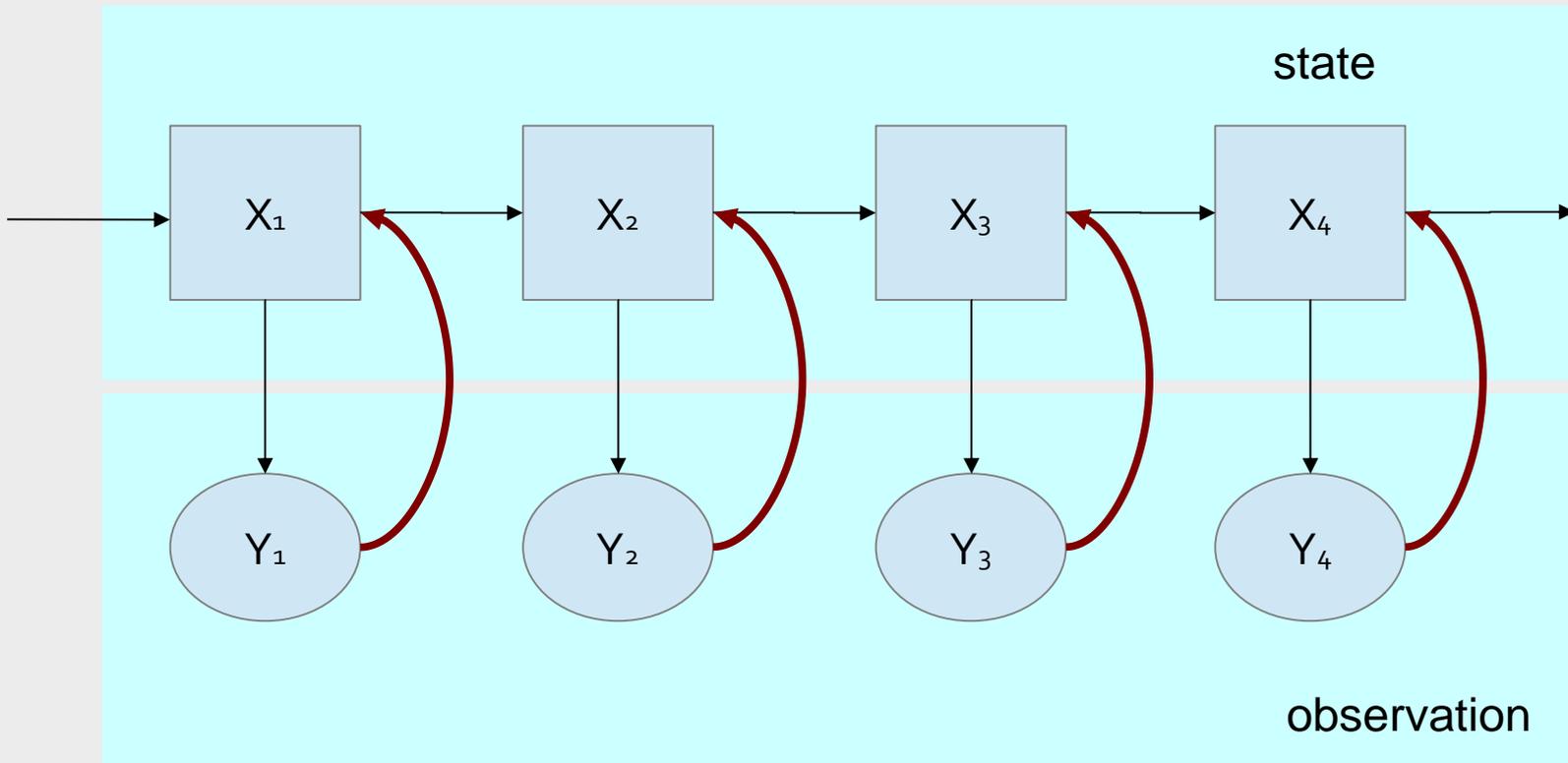
# Cleaning the data

## Hidden Markov Model



# Cleaning the Data

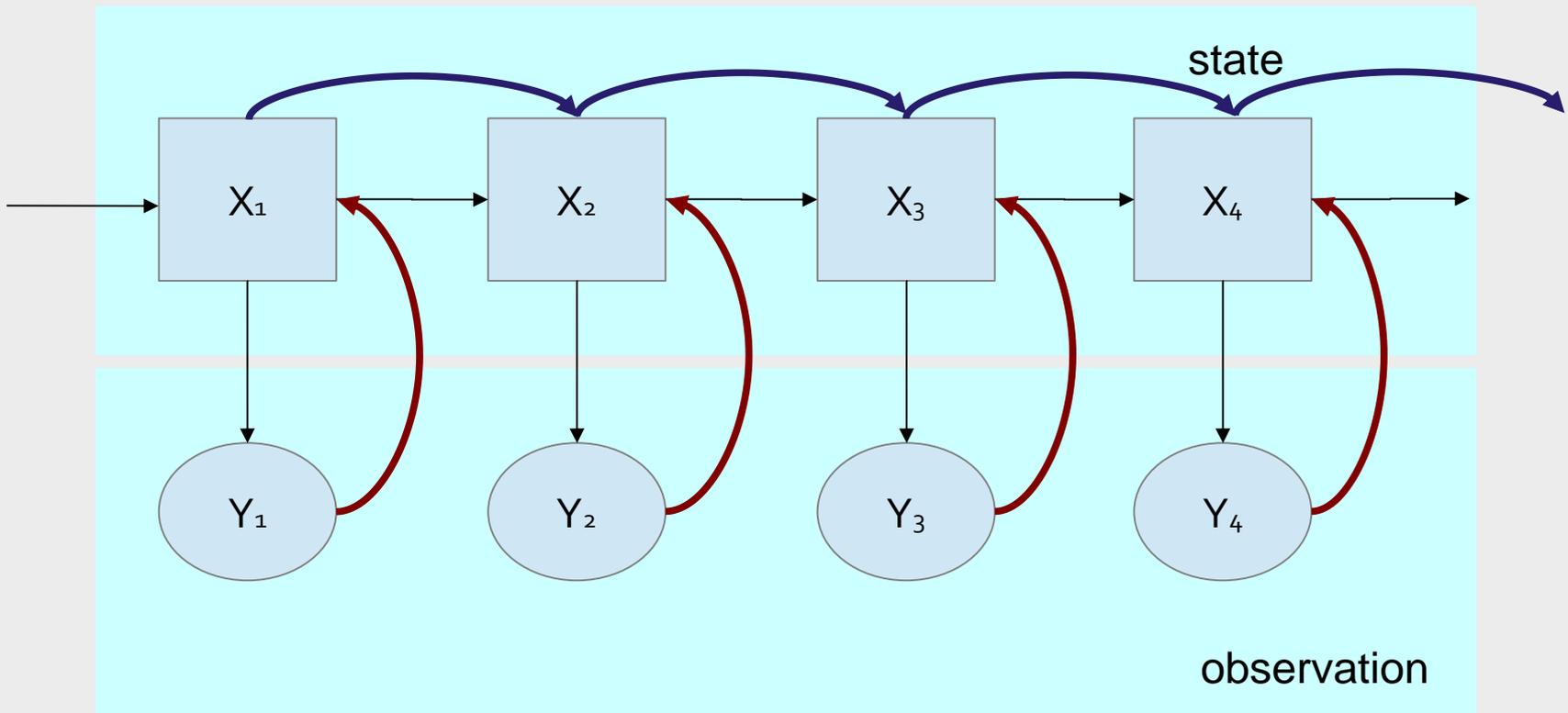
## Recursive Bayesian Estimation



Update

# Cleaning the Data

## Recursive Bayesian Estimation

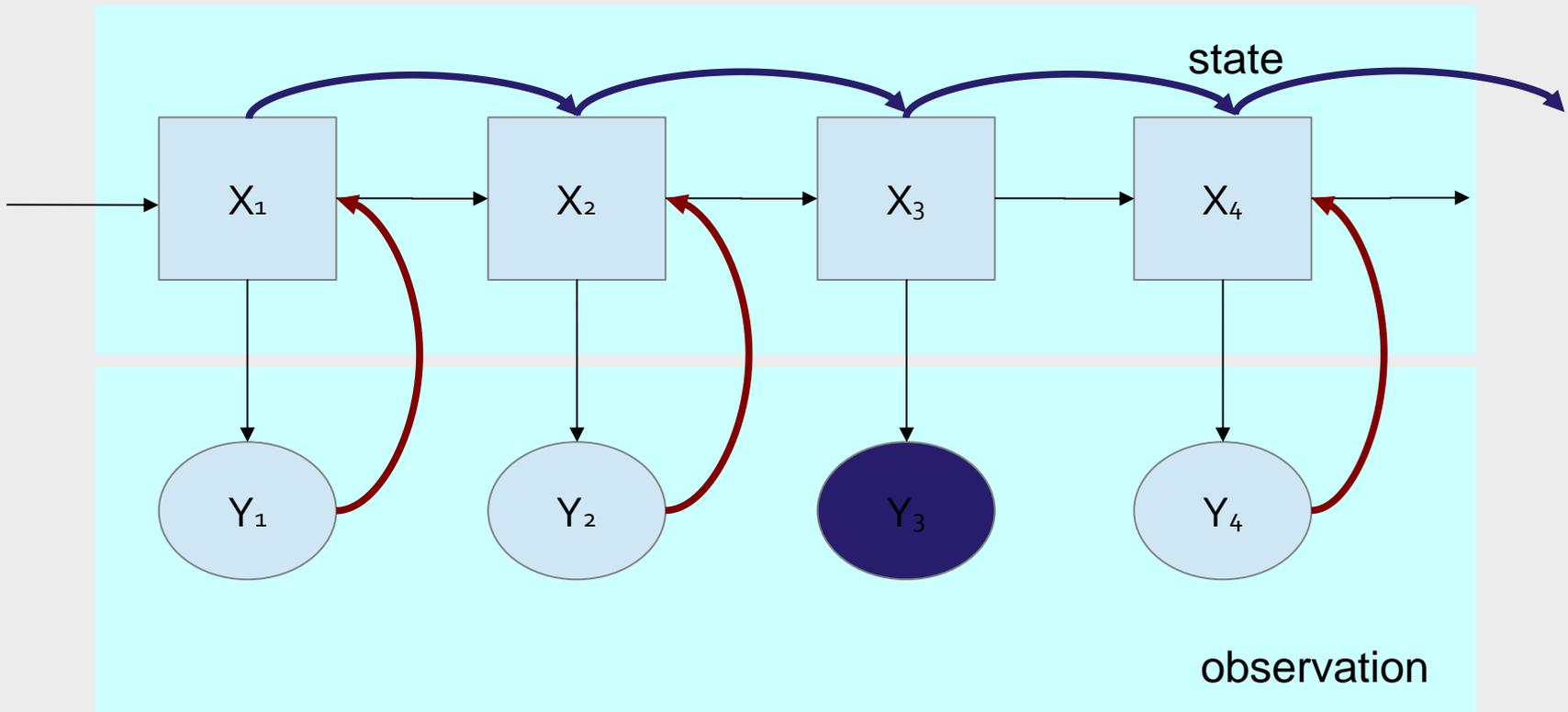


Prediction



# Cleaning the Data

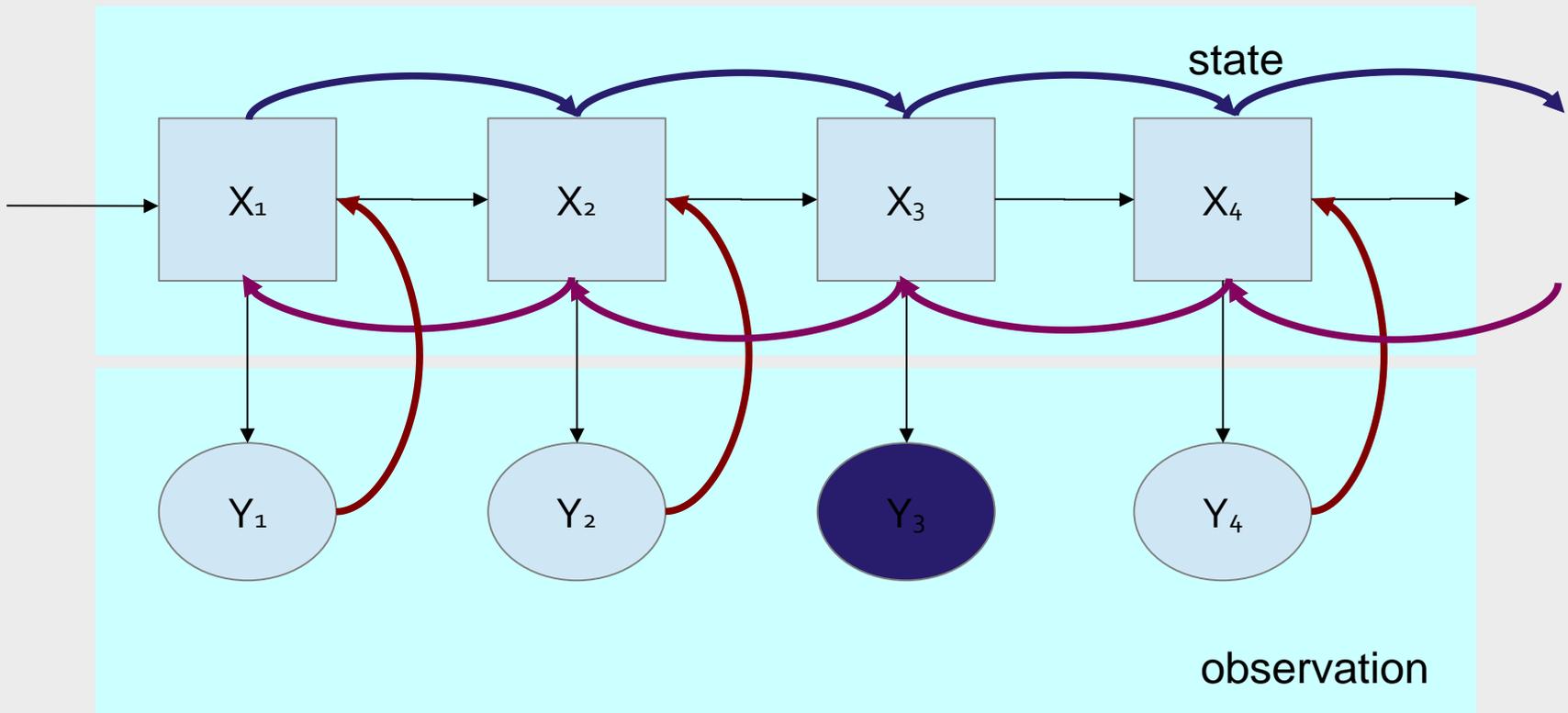
## Recursive Bayesian Estimation



Missing Data

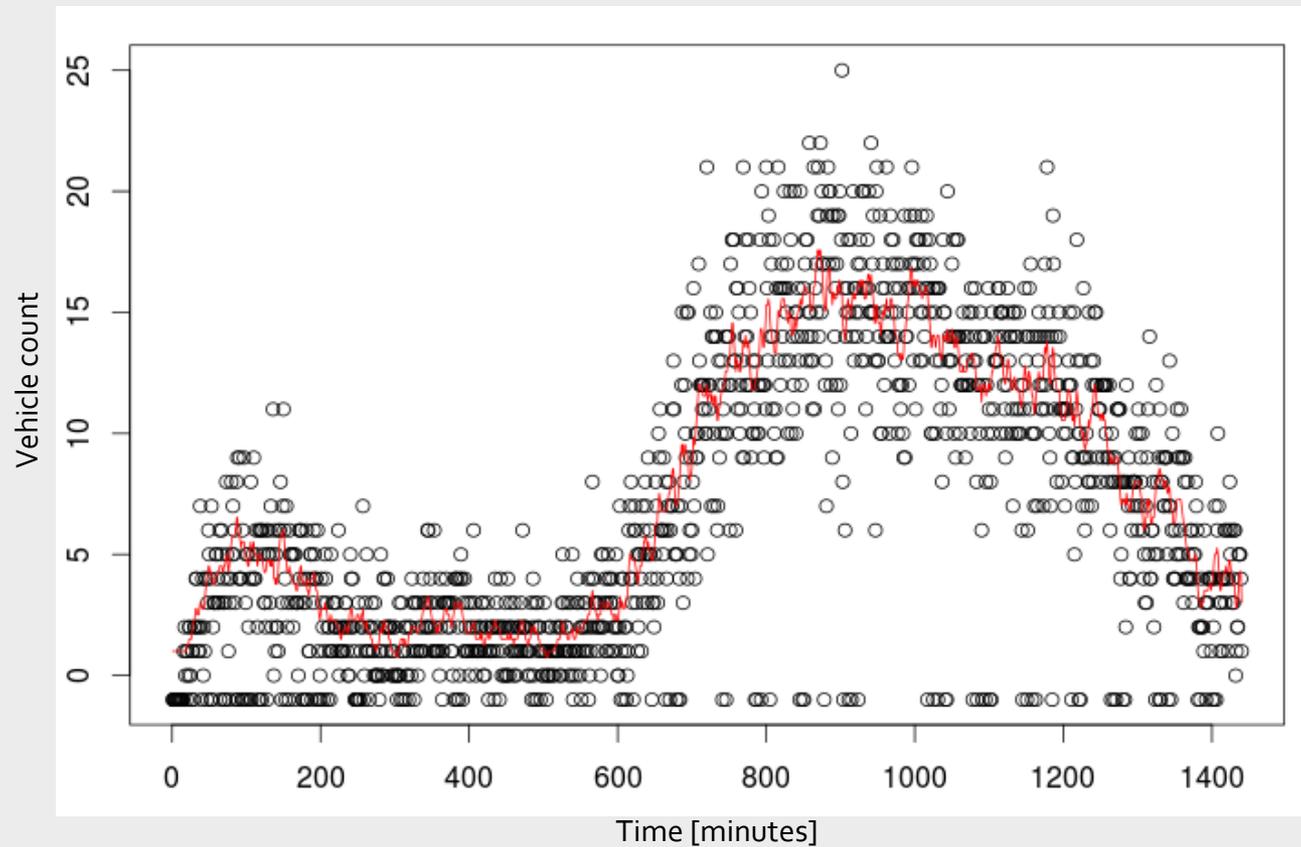
# Cleaning the Data

## Recursive Bayesian Estimation



Smoothing

# Results of the filter



# Precision/Accuracy

The filter does not introduce extra errors:

- Precision: 3.6%
- Accuracy: +0.13%



# Questions

