Catching Drift and Anomalies in Food sales Series

Jorn Bakker

Netherlands Organisation for Scientific Research

Sligro FOOD GROUP N.V.

TU/e Technische Universiteit **Eindhoven** University of Technology
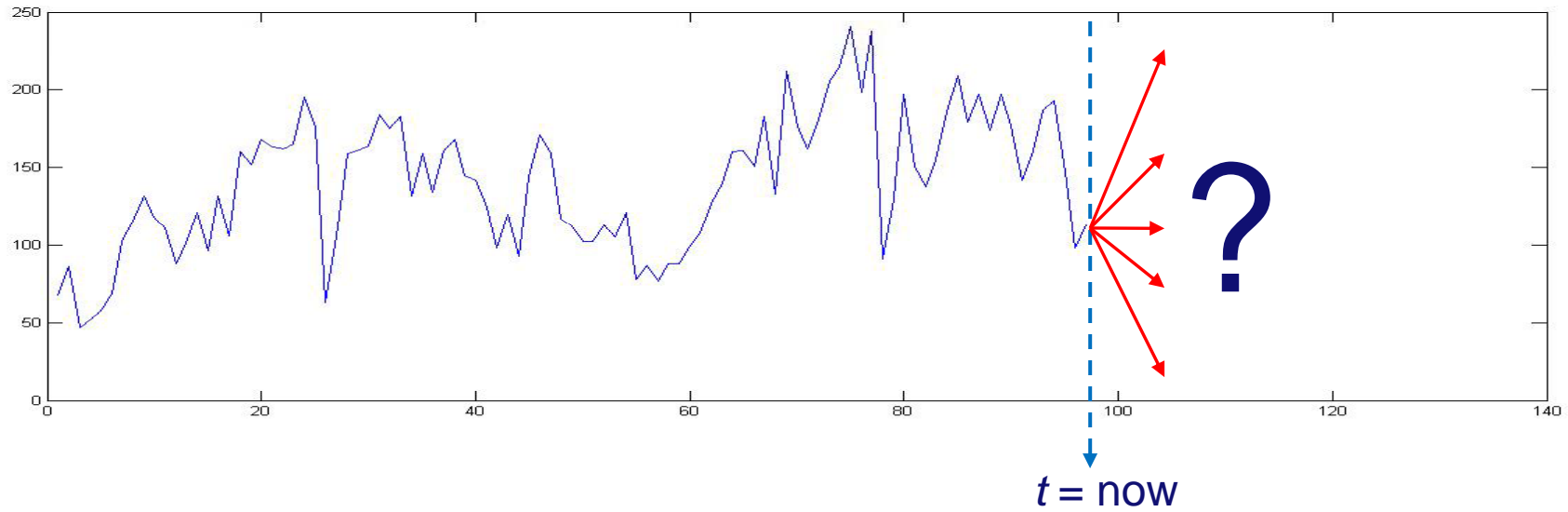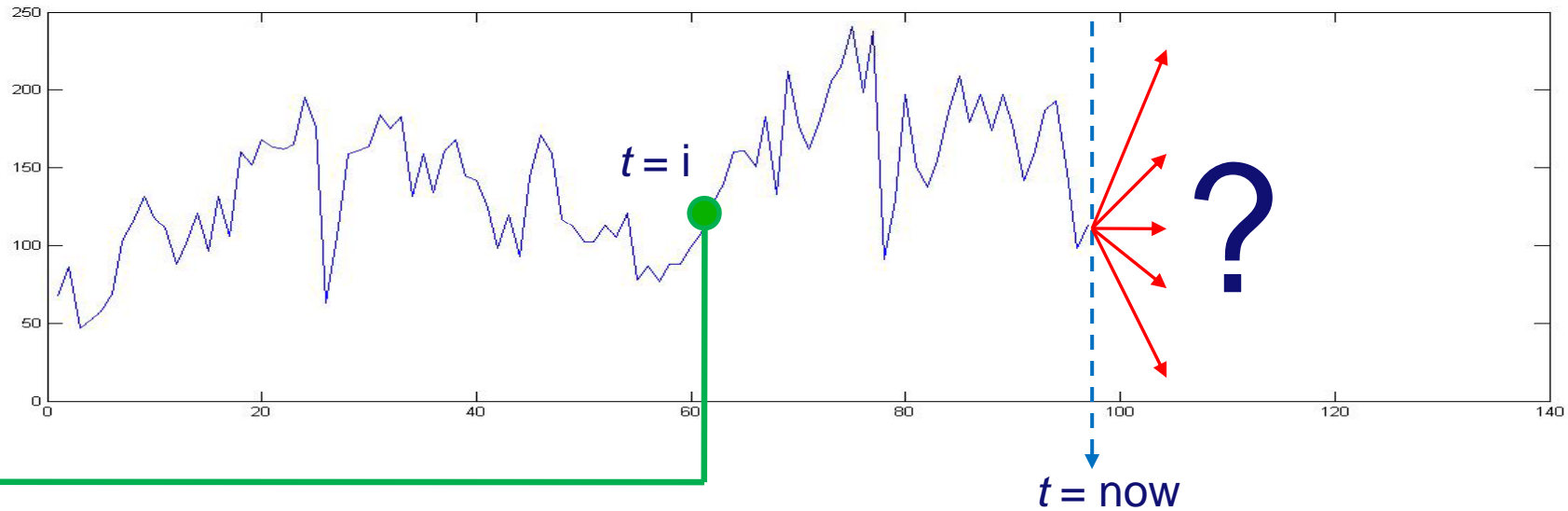
Where innovation starts

Stock balancing

Overview

- **Food sales prediction..**
- **...and its problems**
- **Online learning cycle**
- **Outlier detection**
- **Adaptive windowing**
- **Experimental setup**
- **Results**
- **Future**

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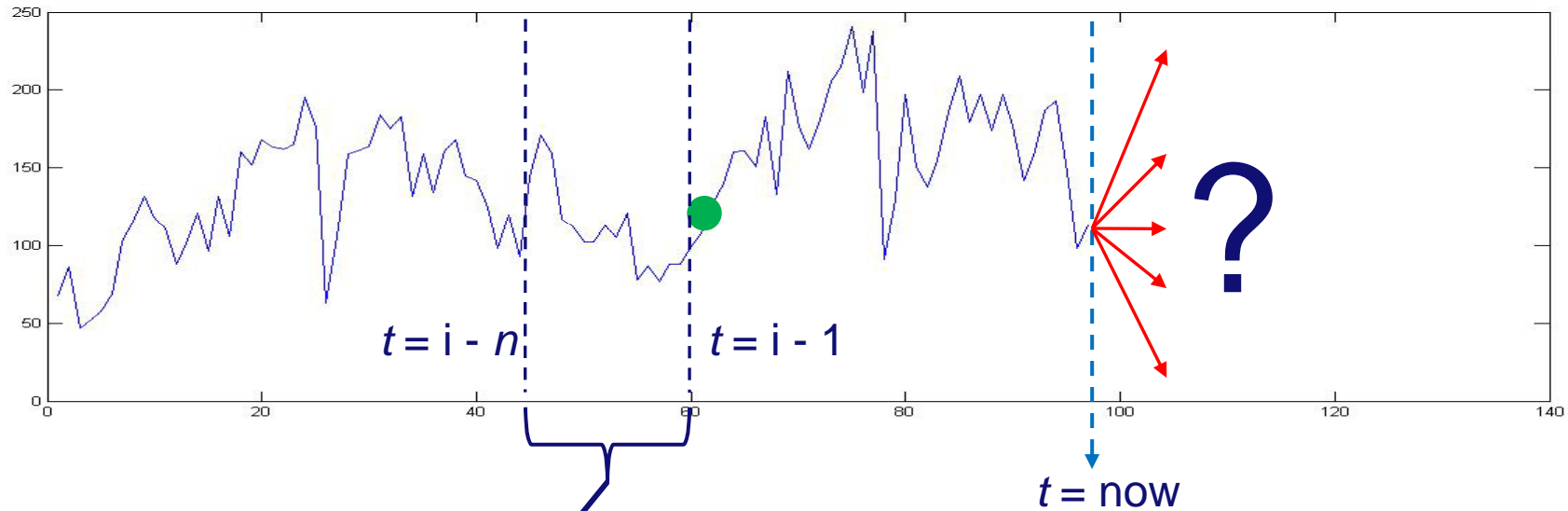**Eindhoven**
University of Technology

Food sales prediction

t = now

Food sales prediction

t	History	Temp	Holiday	Promo
1				
.				
i				
.				
n				

Food sales prediction

t	History	Temp	Holiday	Promo
1				
.				
i	{y(i-n) .. y(i-1)}			
.				
n				

Labels on chart: $t = i - n$, $t = i - 1$, $t = $ now, ?

Food sales prediction

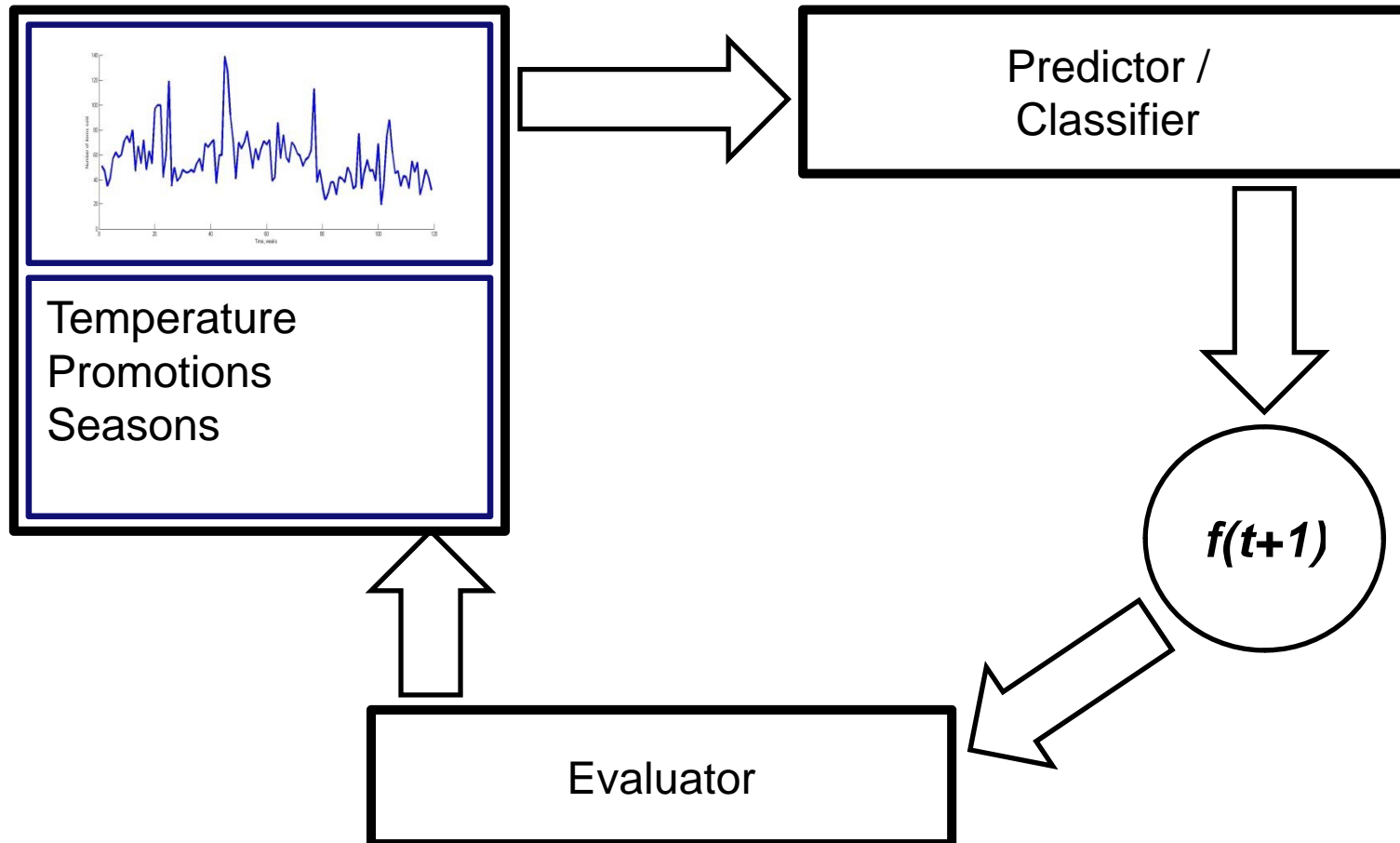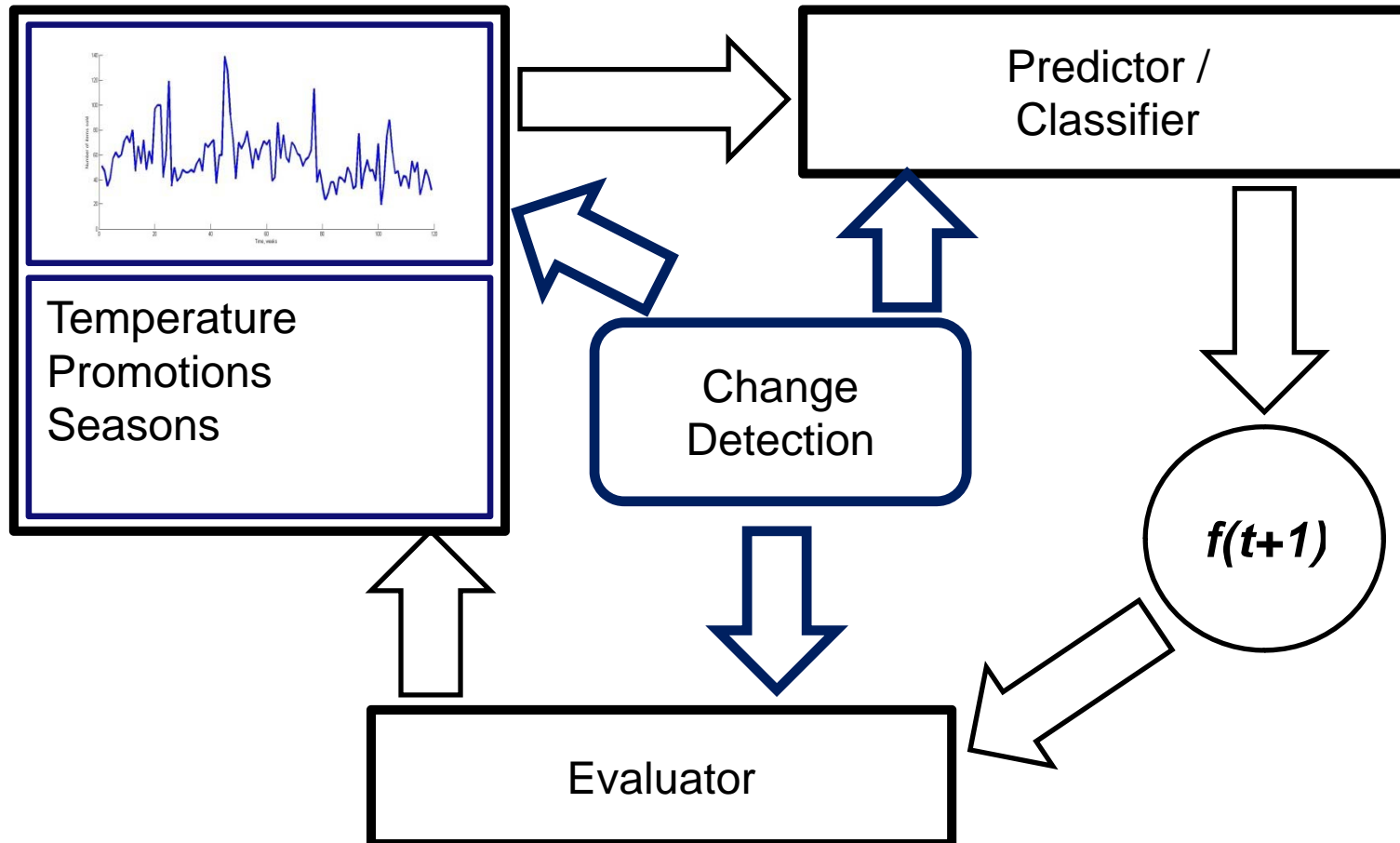| t	History	Temp	Holiday	Promo
1				
.				
i	{y(i-n) .. y(i-1)}			
.				
n				

External Features

Problem
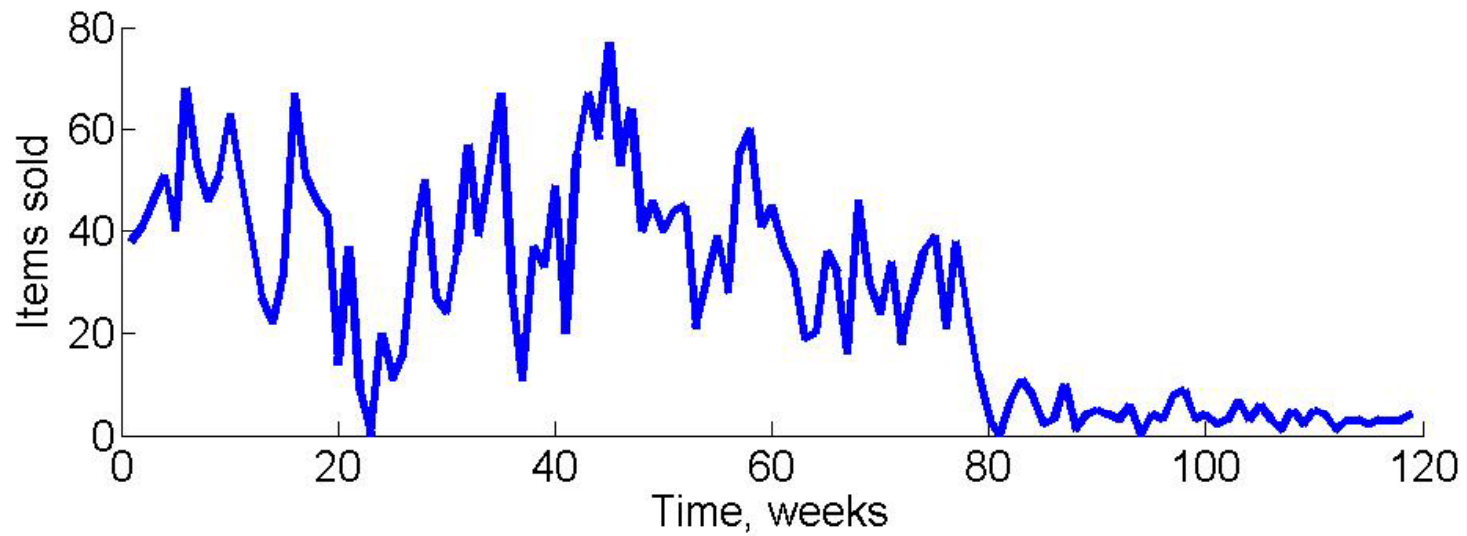
Problem statement

"Find out whether the behavior of the series change with respect to history,
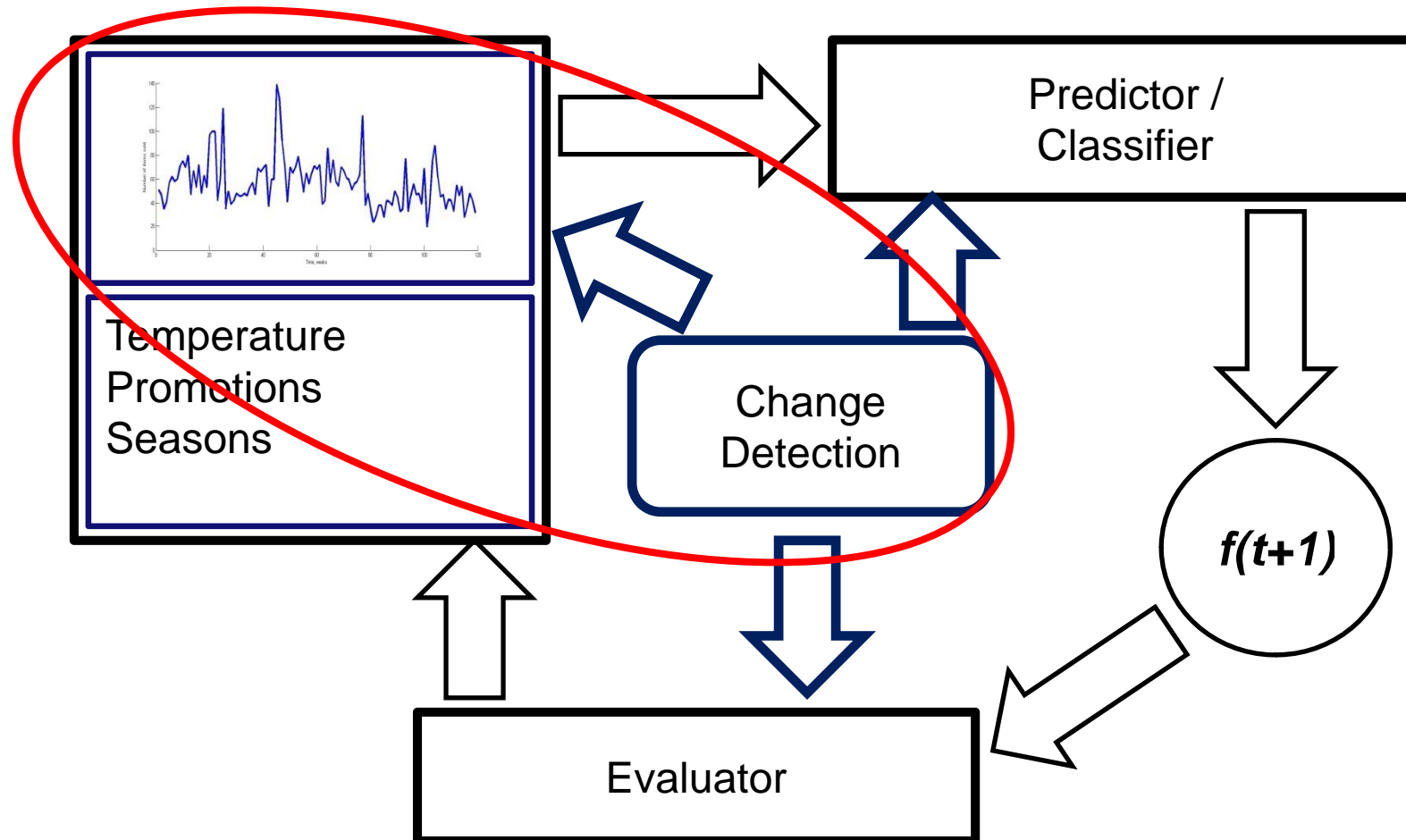
as accurate as possible and

as soon as possible"

Online Learning Cycle
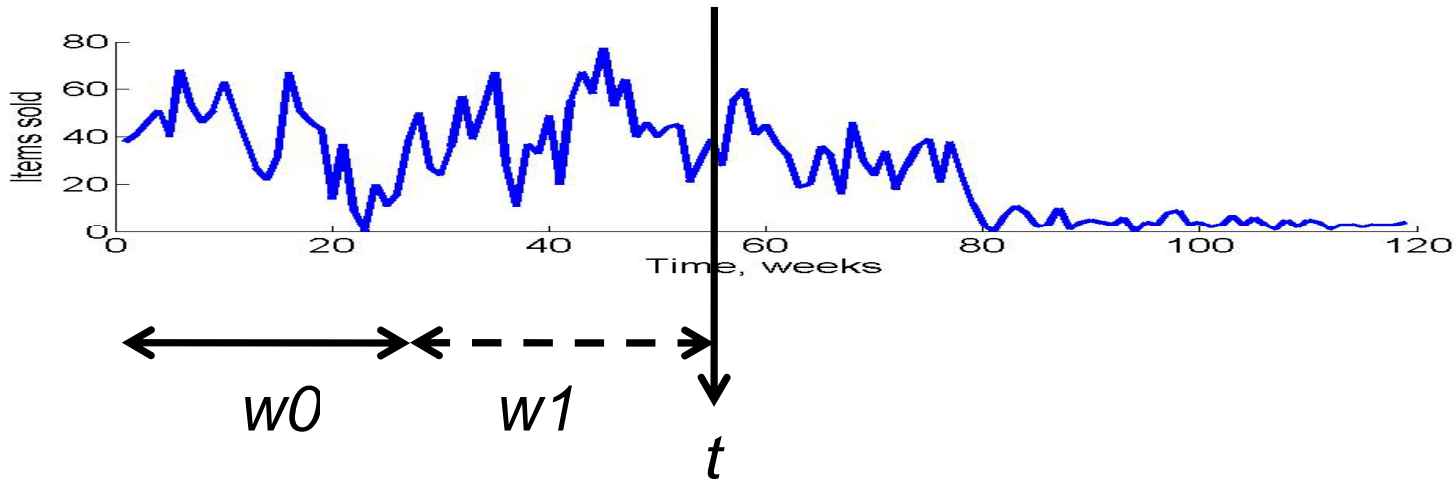
Online Learning Cycle

Online Learning Cycle

Outlier detection

If for any new instance **y** at time **t** :

$$y_t > \left| \mu_{1..t-1} + 3\sigma_{1..t-1} \right|$$

It is replaced by: $\mu_{1..t-1}$

Adaptive windowing
(ADWIN A. Bifet and R. Gavaldá. '07)

$$m = \cfrac{1}{\cfrac{1}{n_0} + \cfrac{1}{n_1}}$$

$$\varepsilon = \sqrt{\frac{1}{2m} \ln \frac{4}{\delta'}}$$
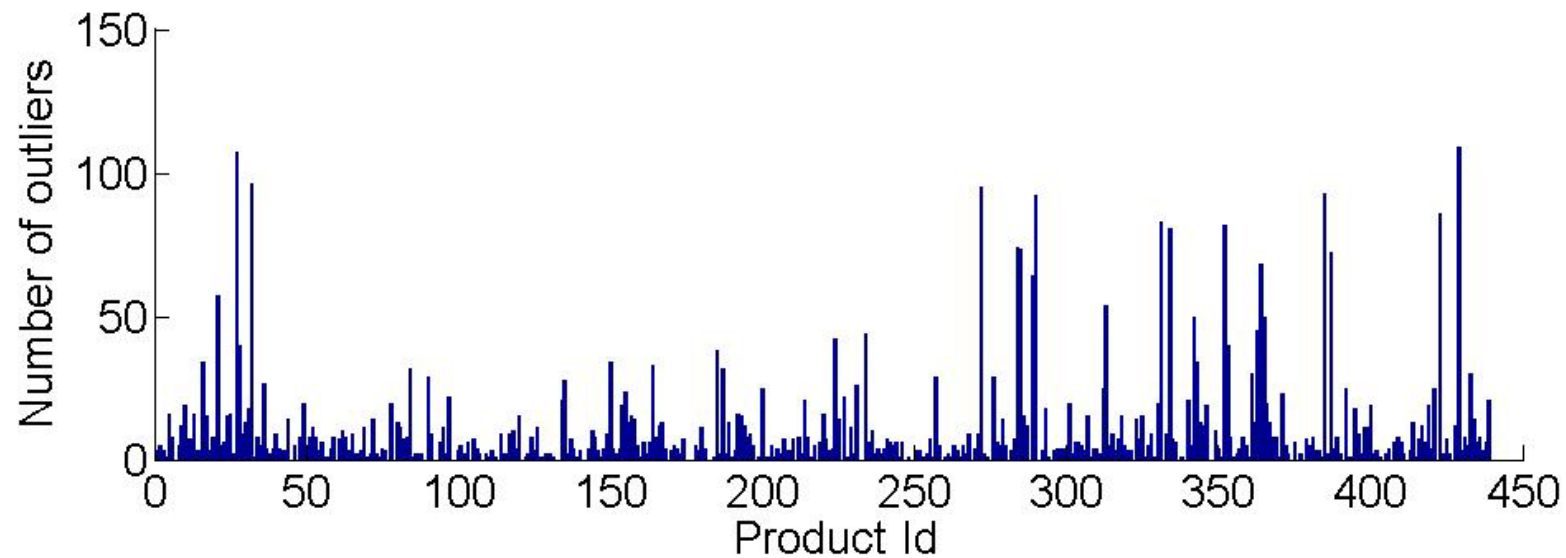
$$\delta' = \frac{\delta}{n}$$

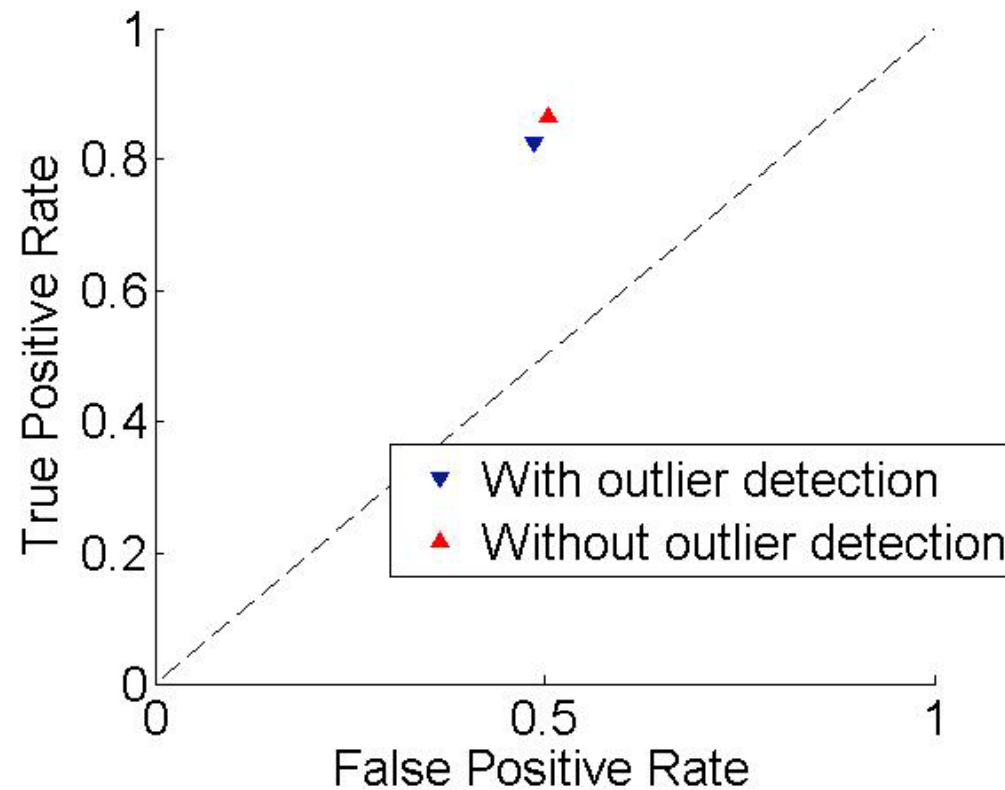$$\left| \mu_{w0} - \mu_{w1} \right| > \varepsilon$$

Experimental setup

- **Set of 439 products**
- **Manually labeled**
  - **behavior is drifting or not**
  - **Timestamp of occurence**
- **Warmup period of 60 weeks, the rest is used as test**
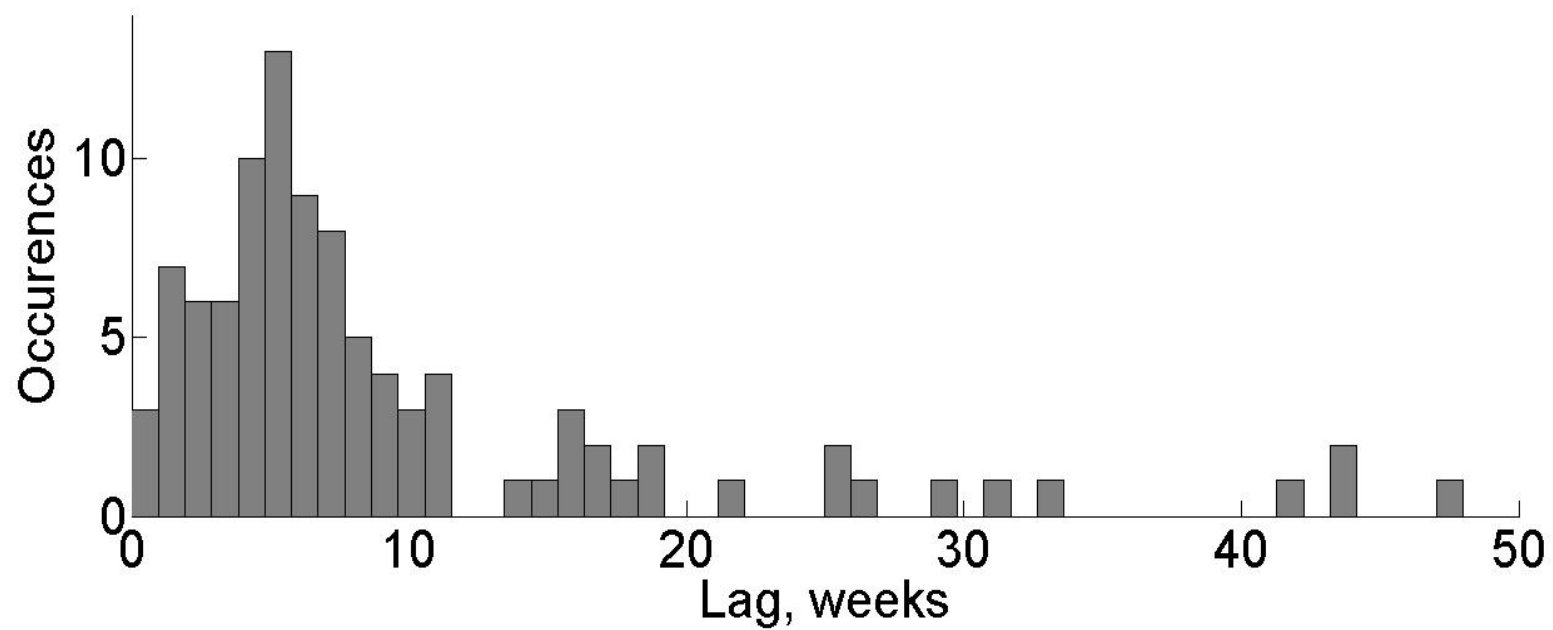- **Each series is transformed to binary series by :**

$$y_t < \mu_{1..t}$$

Results : Outliers

Results : ROC
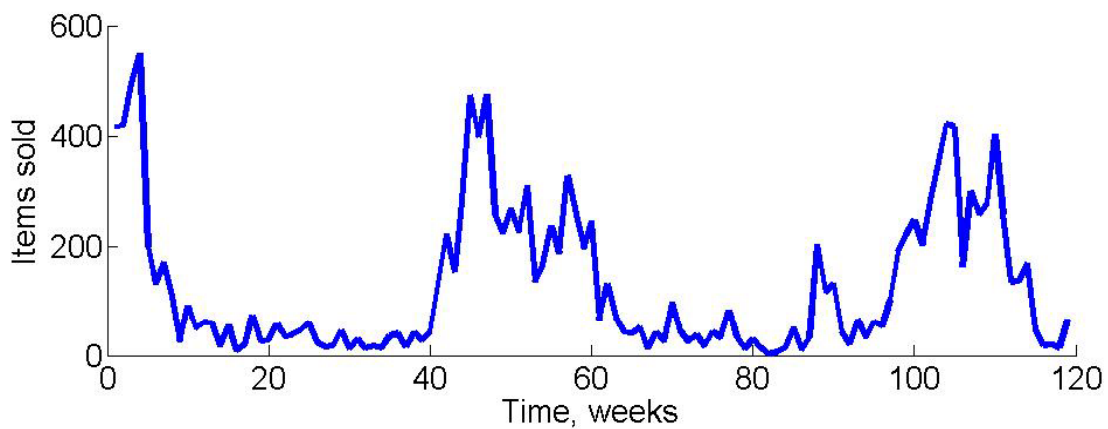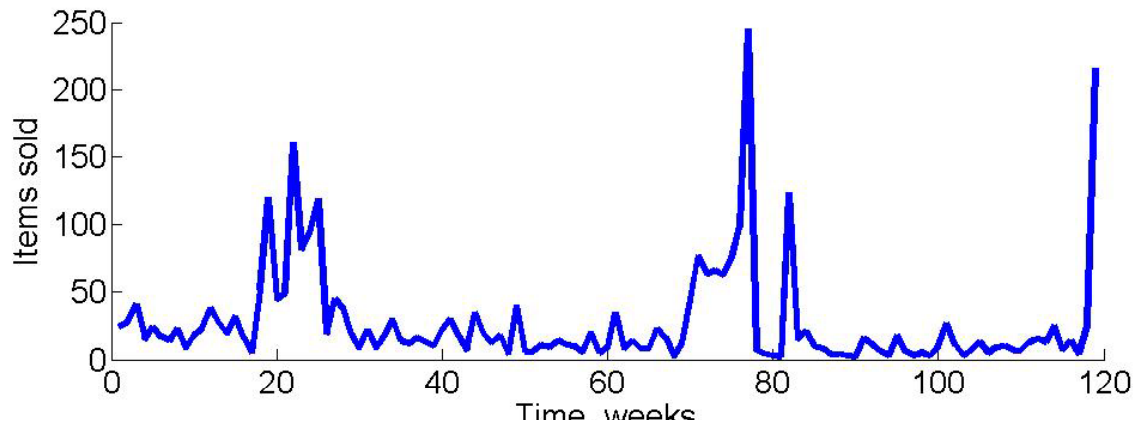
Results : Lag

Future

- **Need for less lag**
- **Need for better outlier detection**
- **What about seasonal patterns?**
  - ■
  - ■
  - ■
- **"Closed loop" evaluation**

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This slide is intended as the last slide

Some false positives

Some false negatives