

# Time series forecasting from a deep learning perspective

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# Inovretail

- Retail intelligence company
  - Smart staff allocation
  - Advanced sales models for staff
  - Customer data and insights
  - Fitting room assistance and recommendations
  - Daily tasks execution and real time urgent task awareness
  - and more .....



# Forecasting & Business

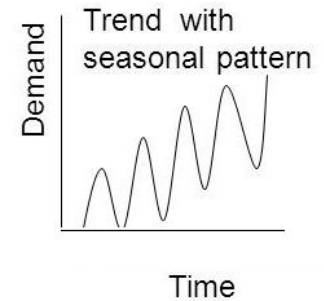
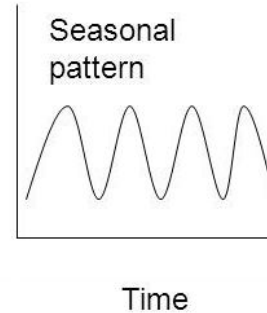
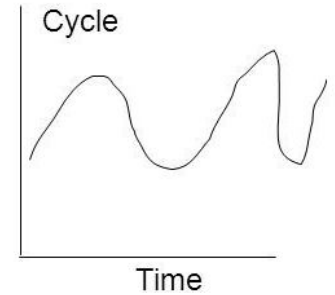
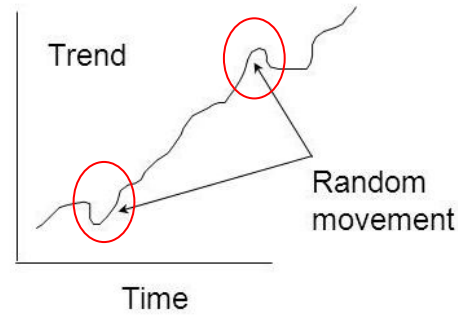


1	Month	Net Sales
2	1	155
3	2	185
4	3	153
5	4	145
6	5	96
7	6	123
8	7	220
9	8	260
10	9	242
11	10	175
12	11	100
13	12	99
14	13	127
15	14	176



# Time series components

- Trend variation: may be linear or nonlinear showing a slow rise or fall in the same direction
- Cyclical variations: non-seasonal component that varies in a recognizable cycle
- Seasonal variation: changes which repeat themselves within a fixed period
- irregular variations



# What the literature says ?

## Statistical models

- Exponential Smoothing
- FFT
- Autoregressive Integrated Moving Average
- ...

## Machine Learning

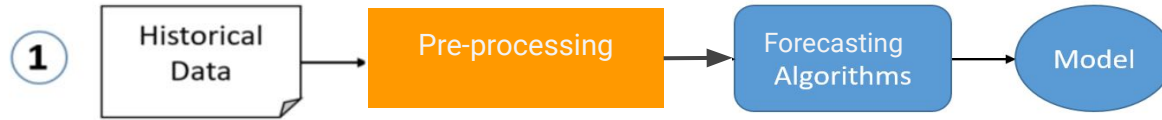
- Quantile Regression
- Forest
- Time delay neural network
- Support Vector Regression
- Recurrent Neural Networks
- ...

## Deep Learning (seq2seq)

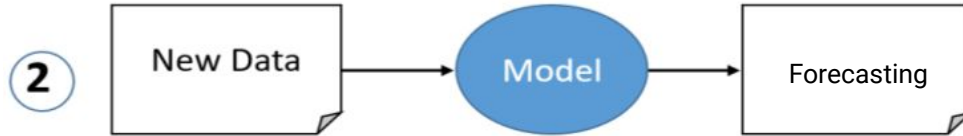
- Architectures
  - LSTM
  - GRU
  - ...
- Learning Algorithms
  - Backpropagation
  - Adam Optimizer
  - ...
- Explanations

# What is the problem ?

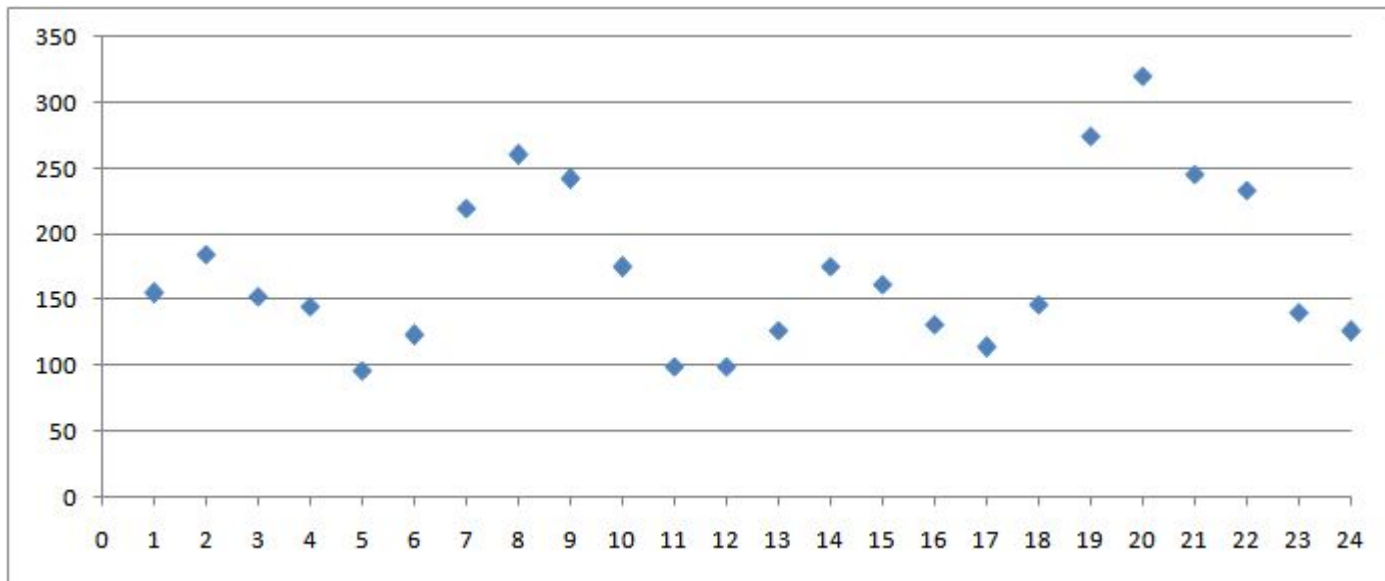
1. Assumptions are not convenient



2. Models remain black boxes



# Deep Learning (Seq2Seq)

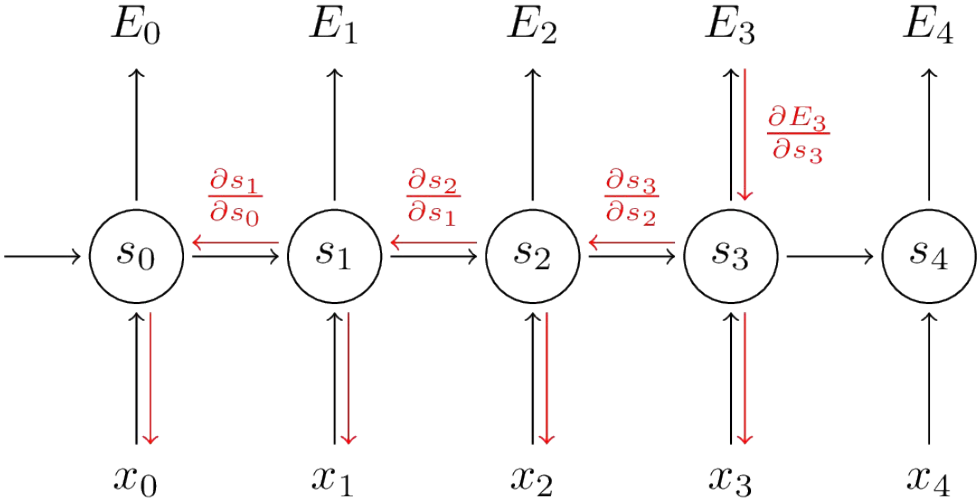


# Deep Learning (Seq2Seq)

Feedforward

Compute Errors

Update Weights





# Research & Business Contributions

## Controlled Learning

**Non-interpolation**  
defines the relevance to inputs individually. By controlling inputs, we are able to control the whole learning.

## Adaptive Forecasts

**Controlled Learning**  
shifts learning from error-oriented to problem-oriented.

## Explanations

**Why should we trust the models ?**  
The user knows what the model forecasted and why it took such decision



# Welcome for feedback

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