Outline

Definition: time series
Classical analysis
HPC Forecasting
Examples
Time Series Forecasting
Time Series Forecasting

Definition: \( F(t) \)

Applications:

Statistics, signal processing, pattern recognition, econometrics, weather forecasting, earthquake prediction, electromedicine, control engineering, astronomy, communications, Oil & Gas...
Time series
Classical Analysis

Regression techniques
Linear prediction
Curve Fitting
Exponential smoothing
Auto-correlation
Spectral analysis
Function approximation
Interpolation
Classical Analysis

Source: https://otexts.com/fpp2/nonlinear-regression.html
WARNING!, STOP!, DANGER!

Correlation: 99.26% (r = 0.992558)

Source: http://www.tylervigen.com/spurious-correlations
HPC Forecasting

Long term forecasting
Time resolution
Several Inputs/outputs
Artificial Intelligence + HPC
Recurrent Neural Networks

\[ F(t) \]

Input(s)  \[ F(t) \]  Output(s)
Long Short-Term Memory (LSTM)

Examples

\[ f(t) = \sin(t) + \text{noise}(t) \]

Air Quality, source:

Steps

Collecting historical dataset
Data engineering (Pre-processing)
Data augmentation (interpolation, smoothing...)
Model Design (CNN, RNN, LSTM, GRU...)
Training (GPU libraries – Keras, Pytorch...)
Testing
Data Pre-processing

- Scaling
- Oil Rate (m³/day)

Oil Rate in Producer 7

- Noising
- Outliers

Time (Days)

1600 1800 2000 2200 2400 2600 2800 3000 3200

0 500 1000 1500 2000 2500
Data Pre-processing

Training

Testing

Oil Rate

Time (Days)
Example: Oil Forecasting

Source: V. Martinez and A. Rocha. Oil & Gas Production Forecasting based on LSTMs. 2020.
Example: Gas Forecasting

Source: V. Martinez and A. Rocha. Oil & Gas Production Forecasting based on LSTMs. 2020.
Example: Water Forecasting

Source: V. Martinez and A. Rocha. Oil & Gas Production Forecasting based on LSTMs. 2020.

Δt = 10 days
Correlation does not imply causation