

PROJECT PLAN

Deep learning for Alarm project

Korean, 2019 March 20

1 - Introduction

Target: Detect or predict alarm event of industrial system based on the time series data (sequence of observation over time line): For example, monitoring signal from sensor devices such as temperature, humidity, pressure, variation sensor, ... for warning about the anomaly situation.

Method: Using deep learning based method on time series data.

2 - Survey

We can form our problem as *Classification* or *Prediction*.

Classification: We have to training data in both situation normal and anomaly (alarm event) to support for training deep learning based classifier.

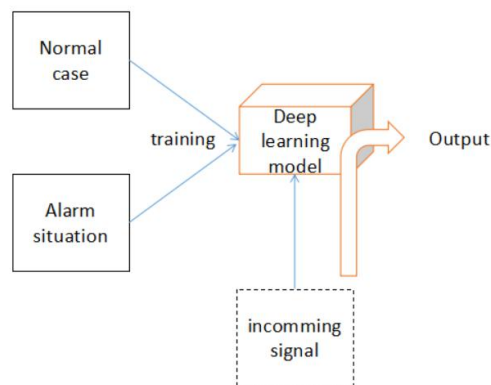


Figure 1: Illustration of classifier based alarm

Prediction: We require training data on the normal situation only. These normal data will be used for training deep learning based predictor model. To detect or forecast alarm event, we consider the comparison the actual value and predicted value. Alarm usually when actual value very different from the predicted value.

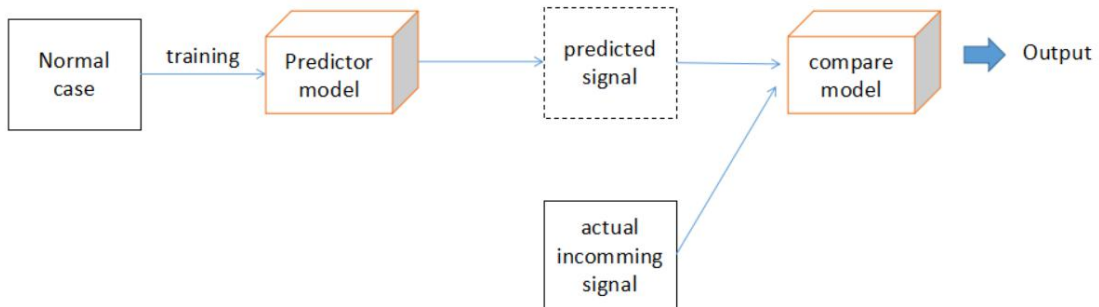


Figure 2: Illustration of predictor based alarm

There are some different approaches that can be used with time series data as following.

- Learning from raw data: Multi-layer Perceptron (MLP), Convolutional Neural Network (CNN), and Recurrent Neural Network(RNN) can be used.
- Transforming data before entering neural network is common practice.
 - Feature extracting:
 - Filtering method: remove trend, seasonality, low-pass, high-pass, ...
 - Change domain: Time domain, frequency domain, wavelet transform (time-frequency domain)
- Consider time series as image
 - Encode time series data as image using methods: Recurrent Plot, Gramian Angular Summation Field (GAF), Gramian Angular Difference Field (GADF), Markov Transition Field,.... to utilize deep learning model from computer vision.

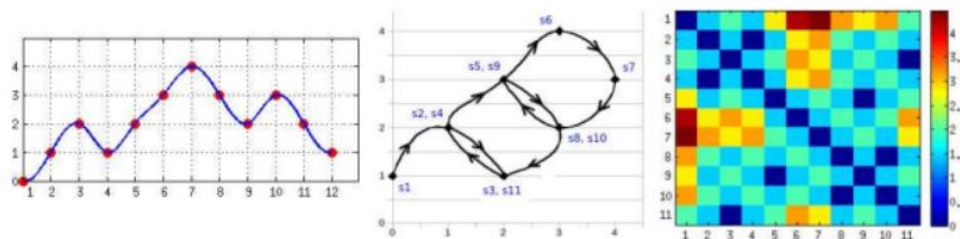


Figure 3: Illustrate encode time series data as image

3 - Proposed approach

The proposed method can be changed or improved during progressing.

4 - Methodology

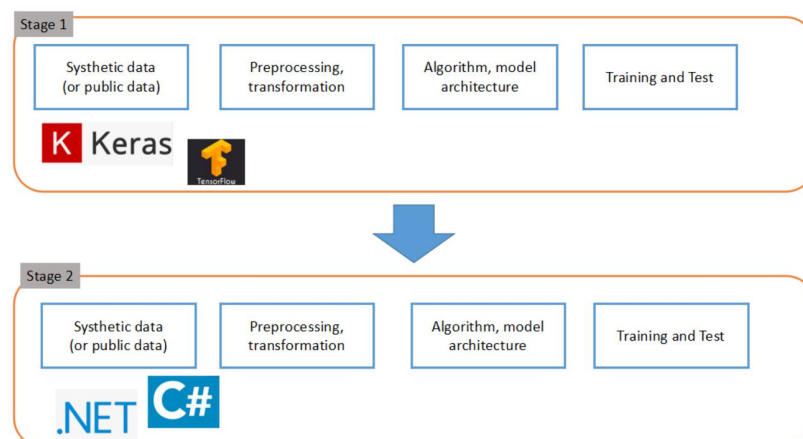


Figure 4: Methodology

- Deep learning on univariate time series data
- Deep learning on multivariate time series data
- Implement on C# using available library on .Net or make an framework for deep learning computing.

5 - Plans

No	Content	Time
1	Survey and idea	2019.Mar.18 - 2019.Mar.29
2	Neural Network based model on univariate time series data (using Keras lib with Tensorflow backend)	2019.Mar.29 - 2019.April.29
2.1	- <i>Predictor model with MLP</i>	
2.2	- <i>Predictor model with CNN</i>	
2.3	- <i>Predictor model with LSTM (improved version of RNN)</i>	
3	Neural Network based model on multivariate time series data (using Keras lib with Tensorflow backend)	2019.April.29 - 2019.May.29
3.1	- <i>Predictor model with MLP</i>	
3.2	- <i>Predictor model with CNN</i>	
3.3	- <i>Predictor model with LSTM (improved version of RNN)</i>	
4	Implementation on C# using available library or (build a frame work by our self)???	2019.May.29 - 2019.August.29