

Time-series Forecasting to Detect Abnormal Situation by Deep Learning Approach

Najafi, E. (ITMO University)

Academic Supervisor: Ph.D. Ivanov S.V., ITMO University,
Institute of Design & Urban Studies

Time series analysis is useful when you want to extract information from a time series or predict future situations. Nowadays deep learning plays a crucial role in time series forecasting. The objective of this research is to forecast the changes and events in the future using Recurrent Neural Network which remembers some information about a sequence.

A time series is a sequence of observed values ordered through time. For example, the air temperature in meteorological science, blood pressure in biomedical science, or vibration in mechanical engineering or civil engineering are examples of a time series. Time series is a collection of data points collected at constant time intervals. These are analyzed to determine the long term trend so as to forecast the future or perform some other form of analysis. Time series are widely used for non-stationary data, like economics, weather, stock price, and industrial parts. Understanding a dataset, called time series analysis, can help to make better predictions. Given a continuous time series, you can digitize the values at a specified time interval to obtain a discrete-time series. Time series analysis is useful when you want to extract information from a time series, to discover the characteristics of a physical system that generates the time series, to predict the changes of a time series, or to improve control over the physical system. In Time series you can use observed values to predict the future values of a time series. For example, you can predict the future variation of a time series in an industrial process and make sure the process is working properly. And also, you can use the predicted values of a time series to determine appropriate corrective actions that you take to specify optimal settings for the controller and keep a physical system or process operating properly.

In this investigation, we will demonstrate different approaches for forecasting time series by using deep learning. Recently, deep learning has emerged in the machine learning field achieving impressive performance in a vast range of tasks, from image classification to machine translation. For forecasting, we will use Recurrent Neural Network (RNN) are a type of Neural Network where the output from the previous step are fed as input to the current step. The main and most important feature of RNN is the Hidden state, which remembers some information about a sequence. RNN has a “memory” which remembers all information about what has been calculated. It uses the same parameters for each input as it performs the same task on all the inputs or hidden layers to produce the output.

The objective of this research is to be able to predict events based on signals containing patterns. The first step is to make time-series forecasting for the next step by RNN, and then determine the presence of a pattern and finally predict and control the environmental situation which shows if some event will occur or no.

In this research, because we will be working with sequences of arbitrary length, we will use a Recurrent Neural Network (RNN) to predict several time-series from a number of input signals. We collected our data each 10-second from different sensors for 3 days for predicting one hour later.

Najafi .E.

Scientific adviser: Ph.D. Ivanov S. V.
