timeline: A Time Series Visualization Platform

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1 Introduction

In today's society data plays a import role in many different ways. For instance, businesses are using large amount of data to predict consumer behavior to satisfy their demand. Often time plays a essential role in these real-world data sets and applications. The following list contains three representative examples in no particular order:

1. The consumption of electricity does not only depend on the time of the day, but also on the day of the week and other seasonal effects. It is important to model the future consumption to avoid failures of large portions or the complete power grid.
2. In the area of weather forecasting time is of the essence. Many applications (e. g., shipping) require an precise and accurate forecasts to operate on minimal risk.
3. In the finance market many decisions are made within small time spans and are based on the prediction of complex models. Incorrect or late data can lead to significant financial losses.

This kind of data sets with an temporal importance are usually referred to as time series (i. e., two- or higher-dimensional data with time as one dimension). A more formal definition [2] of a time series $\{Y\}_t$ is a time ordered collection of observations $(y_1, y_2, \ldots, y_n)$. This implies two trivial consequences. First, the samples in the time series are ordered, and second, privious observations may influcence future values but never the other way around. A element of the time series recorded at time or period t, denoted as y_t, can either be a scalar value or a vector. Time series of scalars are denoted as *univariate* times series, whereas a time series of higher dimensional data is called a *multivariate* time series. For this project we only focused on univariate time series data and refer to to them simply as time series in the context of this paper.

When dealing with time series usually one of the first steps in the analysis process is the visualization of the data. The graphical representation can already give some great insights in properties and characteristics of the data. For example,

a simple visual inspection can show patterns, trends or seasonal effects without the use of advanced statistical methods. These properties are important since they have to be considered in the modeling of the time series. One example for a statistical forecasting model that requires knowledge of the seasonal and stationary properties of a data set is Box–Jenkins [1] model.

The goal of our project is to create a web-based platform that allows the user to perform this initial visual inspection of the time series in a convenient but sophisticated way. This includes, of course, the possibility to create simple time series plots (i. e., visualizations that plot the data against the time) but also more advanced plots such as the auto-correlation function (ACF) plot. Another goal is the support of a quick and responsive visualization of forecasts on the a data set. This means that is should be possible to quickly inspect the deviation of the prediction from the actual test data including a confidence band.

The rest of the paper is structured as follows. Section 2 contains a detailed description of our platform, used algorithms and overall design. Section 3 contains the conclusion of the project and a discussion of possible future work and improvements.

2 Solution

3 Conclusion and Outlook

References

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2. Cortez, P., Rio, M., Rocha, M., Sousa, P.: Multi-scale internet traffic forecasting using neural networks and time series methods. Expert Systems 29(2), 143–155 (2012)

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