

# Visual Analytics for Time Series Model Selection, Prediction, and Imputation

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## Abstract

One of the main goals in time series analysis is to select and fit a model to a given time series. The selection of time series models is done iteratively, usually based on information criteria and residual plots [4]. In this talk, we will present Visual Analytics methods to guide users in the task of seasonal ARIMA model selection employing an interactive visual exploration environment [2], as depicted in Figure 1. In our prototype one can interactively adjust the model order in the autocorrelation and partial autocorrelation plots, which triggers a transition in the residual plots to make the effects visible. If the information criteria and residual plots show only small variations, the prediction capabilities can be used in the model selection process to visually compare the predictions of different models [1]. In summary, the presented approach uses visual interactive interfaces to select and adjust seasonal ARIMA models, utilize the prediction capabilities, and compare the predictions of multiple models in relation to the actual values.

Another challenge in time series analysis are missing values, which need to be imputed before fitting a model. We present a visually and statistically guided imputation approach for missing values in univariate seasonal time series [3], see Figure 2. Our approach allows applying different imputation techniques to estimate the missing values as well as evaluating and fine-tuning the imputation by visual guidance. We include additional visual information about uncertainty and employ the cyclic structure of time inherent in the data. This seasonal structure enables visually judging the adequateness of the estimated values with respect to the uncertainty/error boundaries and according to the patterns of the neighbouring time points in linear and cyclic time (e.g., the months of the year).

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## References

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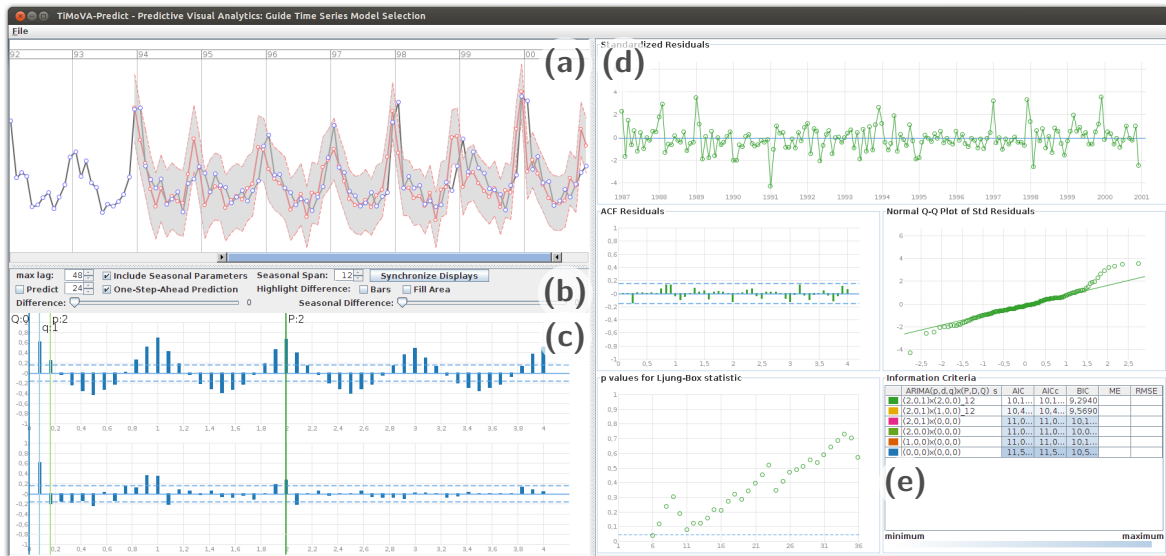


Figure 1: Our interactive seasonal ARIMA model selection environment, displaying: (a) time series line plot showing the one-step-ahead predictions (red) next to the actual values (blue/gray), (b) toolbox for model selection and prediction, (c) autocorrelation and partial autocorrelation plots for selecting the model orders, (d) diagnostic plots for the residual analysis, (e) model selection history including the information criteria.

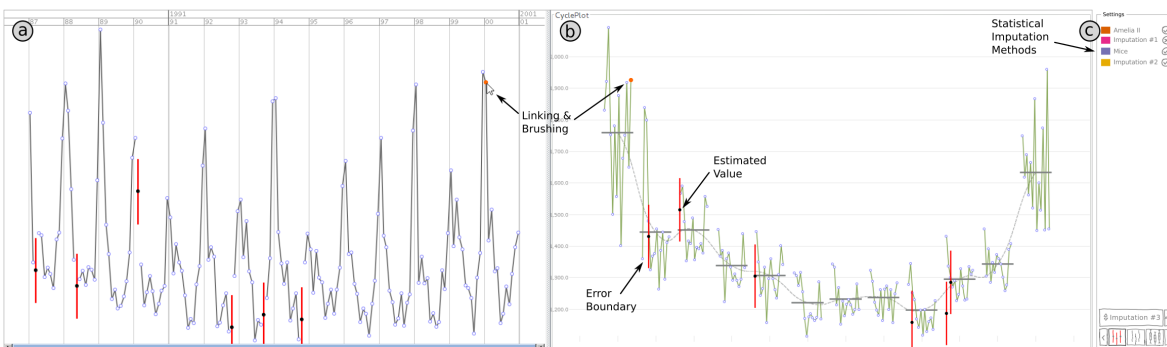


Figure 2: Overview of the visually and statistically guided imputation approach. Coordinated views with (a) a time series line plot using a linear time axis, (b) the corresponding cycle plot, and (c) a configuration panel. The estimated values (black dots) of missing values and boundaries (red bars) are displayed.

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