Time Series Imputation

:: CHEAT SHEET

Mission

Missing Data is nearly everywhere. Also in time series, especially in sensor recordings missing data is common.

imputeTS *helps you with your missing data problems.*

Features

The package provides easy to use functions in these areas:

1. **Imputation Functions**

   Several algorithms for replacing NAs with reasonable values (imputation).

2. **Missing Data Visualizations**

   Plots for analysis of the distribution of NAs, patterns and imputation performance.

3. **Stats and Datasets**

   Functions for printing missing data stats and benchmarking datasets.

Scope

imputeTS specializes on univariate time series that are:

- numeric
- equally-spaced

Visualizations

There are multiple plots provided for analysing the missing data before and after imputation. All plotting functions start with ggplot_na_plotname.

Function	Description
ggplot_na_distribution	Getting a first overview of NAs
ggplot_na_distribution2	Insights about NAs in specific periods
ggplot_na_gapsize	Insights about occurring NA gapsizes
ggplot_na_imputations	Evaluating imputation quality

Imputation

The package offers multiple missing data replacement (imputation) functions, which are really easy to use.

```
na_interpolation(x, option = "spline")
```

Imputation Function | Your input time series | Additional Parameters

List of available Algorithms

Function	Description
na_interpolation	Imputation by Interpolation
na_kalman	Imputation by Kalman Smoothing
na_locf	Last Observation Carried Forward
na_ma	Imputation by Moving Average
na_mean	Imputation by Mean Value
na_random	Imputation by Random Sample
na_remove	Remove Missing Values
na_replace	Replace Missing Values by a Defined Value
na_seadec	Seasonally Decomposed Imputation
na_seasplit	Seasonally Splitted Imputation

Missing Data Overview Plots

The 'distribution', 'intervals' and 'gapsize' plots can be used on new datasets to gain insights about missing data patterns and distribution.


Distribution of Missing Values
Time Series with highlighted missing regions
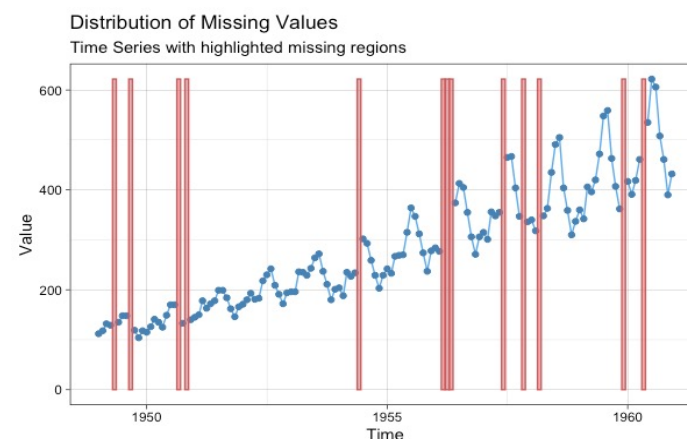
```
ggplot_na_distribution(tsAirgap)
```
example data with NAs

Imputation Analysis Plots

Imputation results can be visualized with the 'imputations' plot. Here first na_kalman is performed and then the results are plotted.

Imputed Values
Visualization of missing value replacements

known values   imputed values
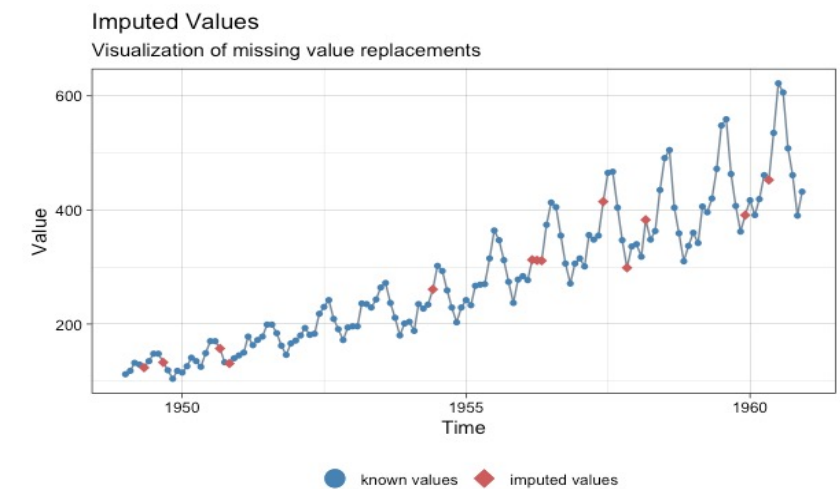
```
imp <- na_kalman(tsAirgap)
ggplot_na_imputations(tsAirgap, imp)
```
imputation
visualization

Workflows

The functions also work well in tidy style pipe workflows. Here an example of first using imputation and later forecasting and plotting.

```
library("forecast")
tsAirgap %>% na_interpolation() %>%
ets() %>% forecast(h=36) %>%
autoplot()
```
can be put in pipe workflows
a 36 step forecast is created and plotted

Datasets

The package includes three datasets for imputation experiments.

Function	Description
tsAirgap	Monthly totals of international airline passengers. 144 Observations / 13 NAs
tsNH4	NH4 concentration in a wastewater system. 3552 observations / 883 NAs
tsHeating	A heating systems supply temperature. 606837 observations / 57391 NAs