Seasonal Adjustment with the R packages x12 and x12GUI

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Motivation

- X12-ARIMA is widely used and state-of-the-art in many statistical offices.
- Statistical offices (we) have to apply seasonal adjustment frequently and to many different time series.
- Graphical analysis should always be included in the process.
- Results should be reproducible and easy to modify.
- (X-13-ARIMA-SEATS is the successor if X12-ARIMA, SEATS not yet implemented)

→ R-packages x12 and x12GUI
Features

- Access to X12-ARIMA directly from within R (no spc, out, ... files)
- Class oriented command line interface
- Change tracking for the X12-ARIMA parameters and output
- Batch processing of multiple time series at once (in parallel)
- Easy generation of graphical output
- Import the parameter settings from spc files to R
Objects of class x12Single contain the following information:

- **ts** - The original time series
- **x12Parameter** - The current X12-ARIMA parameter setting
- **x120output** - The current X12-ARIMA results
- **x120ldParameter** - All previous X12-ARIMA parameter settings
- **x120ld0output** - All previous X12-ARIMA results
Methods x12Single

Methods for this class are:

- **x12** - (Re)Run X12-ARIMA
- **setP, getP** - Change/View parameters
- **prev, cleanHistory** - Revert to a previous X12 parameter setting and output
- **plot, plotRsdAcf, plotSpec, plotSeasFac** - Plot methods

```r
s <- new("x12Single", ts = AirPassengers, tsName = "air")
s <- x12(s)
forecast <- s@x12Output@forecast
```
Class x12Batch

Objects of class x12Batch

- Combination of multiple objects of class x12Single
- Inherit the methods from class x12Single

```r
xb <- new("x12Batch", list(AirPassengers, AirPassengers, AirPassengers))
xb <- setP(xb, list(estimate = TRUE, outlier.types = "all"))
xb <- setP(xb, list(outlier.types = "LS", index=1))
#options(x12.parallel=2)
xb <- x12(xb)
```
> dat <- read.csv2("http://bit.ly/1RTF31S")
> tsObject <- lapply(split(dat[,5], list(dat[,2], dat[,3])),
+   # by state and country of origin
+   ts,start = c(1973,11), frequency = 12)
> length(tsObject)

[1] 774

> xb <- new("x12Batch", tsObject[1:3])
> xb <- setP(xb,list(forecast_years=3))

The parameters for all objects are changed.

> xb <- x12(xb)

Time difference of 6.766999 secs
Real example Batch - Tourism

```r
> plot(xb@x12List[[1]], forecast = TRUE,
+     span = c(2008,4,2018,4), ylab = "Nights spend")
```

![Time Series with Forecasts](image-url)
Output of the \texttt{plot()} method showing trend and forecasts with prediction intervals as well as the seasonally adjusted series.
Plot functions II

Output of the `plotRsdAcf()` function from the R package `x12`, showing the autocorrelations of the squared residuals from the regARIMA model.
Output of the `plotSpec()` function, showing the spectrum of the seasonally adjusted series.
Output of the seasonal factor plot (plotSeasFac()).
Output of the `plot()` method showing outliers in the RegARIMA model.
Features x12GUI

- Overview of all (implemented) X12-ARIMA parameters
- Interactive adjustment of the parameters
- Interactive graphics
- Visualisation of the automatically detected outliers
- Easy addition, removal of manually selected outliers
Main View x12GUI

> xbn <- x12GUI(xb)
Main View x12GUI
Graphics x12GUI
Interactive Plots x12GUI I
Interactive Plots x12GUI II

Original Series and Trend

- AO
- LS
- TC

Date:
- 1950.1
- 1952.1
- 1954.1
- 1956.1
- 1958.1
- 1960.1

Value:
- 100
- 200
- 300
- 400
- 500
- 600
Details and contact

- JSS paper “Seasonal Adjustment with the R packages x12 and x12GUI”

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https://github.com/alexkowa/x12