Cross Validated

Use ACF and PACF for irregular time series?

Asked 4 years ago Active 1 month ago Viewed 3k times

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Given an irregular daily time series where some days are missing, e.g. holidays and weekends.

Suppose `data` is a `zoo` object in R, there are two ways to plot ACF of `data` (PACF in the same ways):

1. `acf(coredata(data))`
2. `acf(data, na.action = na.pass)`

The first approach will reindex the data so the data will be shift to eliminate the holidays and weekend. A regular ts is thus used in ACF.

The second approach will interpolate `NA` in the ts. But I do not know how `acf` function deals with `NA` when `na.action=na.pass` is specified.

The resulting plots were quite different so which approach is the correct one?

r time-series missing-data

edited Jul 20 at 12:13
kjetil b halvorsen
36.4k 9 90 283

asked Aug 10 '15 at 11:01
Zelong
132 1 5

1 Can you please include the plots in the question, which can help in answering it better and also making the question clear. – Dawny33 Aug 10 '15 at 11:04

2 Answers

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The latter approach is preferred since the time difference must be invariant/constant for an ACF/PACF to be useful for model identification purposes. Intervention Detection can be iteratively used to estimate the missing values while accounting for the auto-correlative structure. One can invert the time series--*i.e.*, go from latest to earliest to estimate missing values--and then reverse the process (normal view) to tune the missing value estimates.

edited Aug 10 '15 at 14:31
whuber ♦
216k 34 477 870

answered Aug 10 '15 at 11:31
IrishStat
23.8k 4 24 48

Thank you. Does it mean that I do not need to fill `NA` manually or converted the `zoo` to regular `ts` ? – Zelong Aug 10 '15 at 12:00

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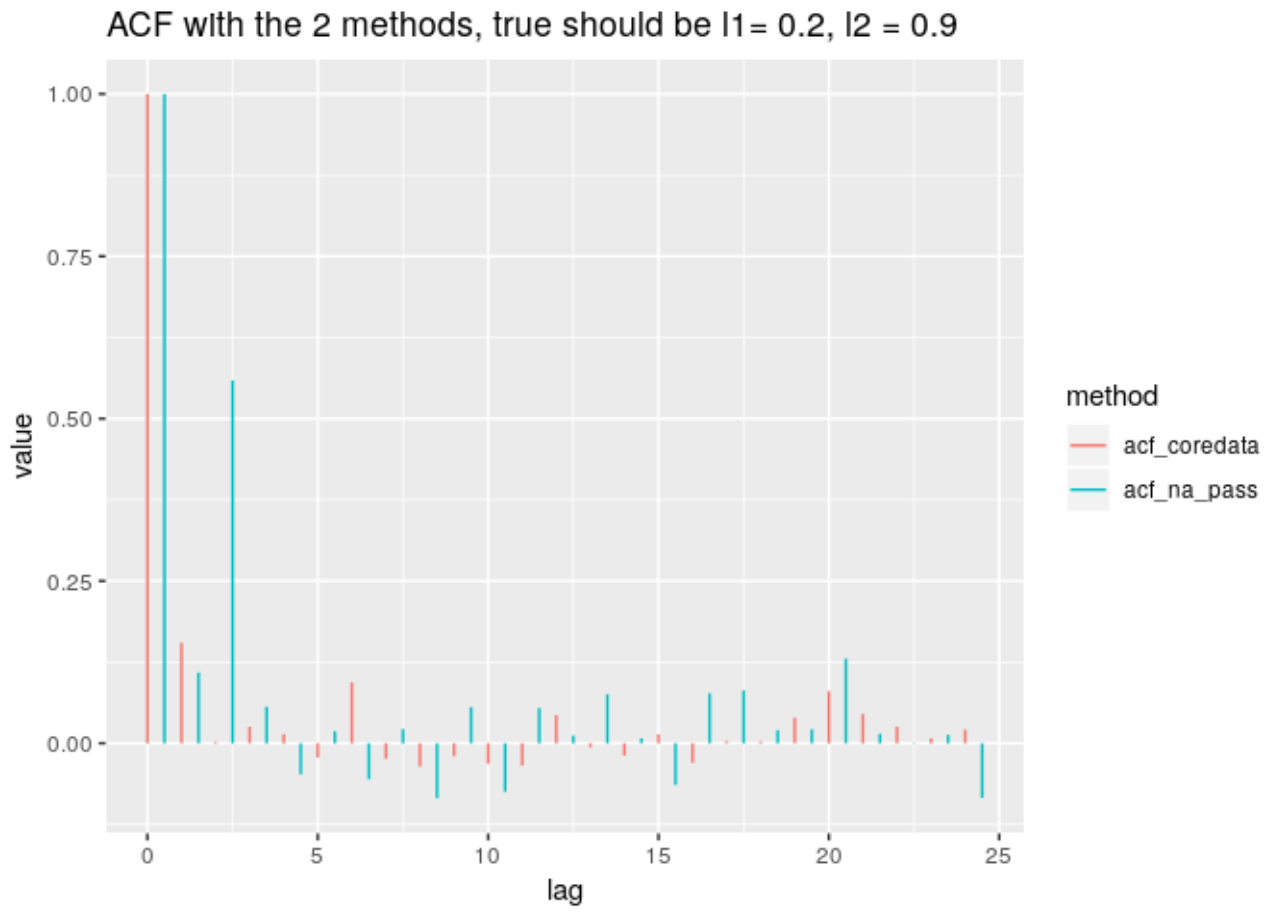
Yes, you should definitely use the second approach: if you do the first, you are considering *distant* observations as *close*. If auto-correlation is decreasing with the lag (as is usually the case) then this would lead to an under-estimation of the ACF values: indeed, using say lag 5 (low correlation) for estimating lag 1 (higher correlation) biases your results. See the plot below to see this result.

Also, no need to fill-in manually NA, as `acf()` is calling `as.ts()`, and `as.ts()` on a `zoo` object returns a vector with NA already.

```
library(zoo)
#>
#> Attaching package: 'zoo'
#> The following objects are masked from 'package:base':
#>
#>     as.Date, as.Date.numeric

N <-  5000
x <- arima.sim(model = list(ma = c(0.2, 0.9)), n = N)

set.seed(123)
index_x <-  sort(sample(1:N, size = N/5, replace = FALSE))
x_miss <-  x[index_x]

x_miss_zoo <- zoo(x_miss, order.by = index_x)


## coredata
ac_1 <- acf(coredata(x_miss_zoo), lag.max = 24, plot = FALSE)
ac_2 <- acf(x_miss_zoo,  na.action = na.pass, lag.max = 24, plot = FALSE)


library(tidyverse)
data_frame(lag = 0:24,
           acf_coredata = ac_1$acf[,1,],
       acf_na_pass = ac_2$acf[,1,]) %>%
  gather(method, value, -lag) %>%
  mutate(lag = ifelse(method =="acf_coredata", lag, lag +0.5)) %>%  #kind of a
hack...
  ggplot(aes(x = lag, y= value, colour = method)) +
  geom_segment(aes(xend = lag, yend = 0)) +
  ggtitle("ACF with the 2 methods, true should be l1= 0.2, l2 = 0.9")
```



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answered Nov 16 '18 at 22:02

Matifou

2,116 8 22