

Parallel Autobox

Automatic Forecasting Systems Inc.

2017-08-18

```
# Save the current working directory.
saveWd <- getwd()

# Move to the Documents\AutoboxR directory.
setwd("~/AutoboxR")

# Load the autobox library.
library(autobox)

# Load the parallel library.
library(parallel)

# Initialize the autobox package.
autoboxInitPackage()

## [[1]]
## [1] 0
##
## [[2]]
## [1] "License status: active license, will expire on Fri Aug 18 14:57:19 2017."

# Set the BJ07 historical values.
dblHistorical_BJ07 <- c(112.000000,118.000000,132.000000,129.000000,121.000000,
135.000000,148.000000,148.000000,136.000000,119.000000,104.000000,118.000000,
115.000000,126.000000,141.000000,135.000000,125.000000,149.000000,170.000000,
170.000000,158.000000,133.000000,114.000000,140.000000,145.000000,150.000000,
178.000000,163.000000,172.000000,178.000000,199.000000,199.000000,184.000000,
162.000000,146.000000,166.000000,171.000000,180.000000,193.000000,181.000000,
183.000000,218.000000,230.000000,242.000000,209.000000,191.000000,172.000000,
194.000000,196.000000,196.000000,236.000000,235.000000,229.000000,243.000000,
264.000000,272.000000,237.000000,211.000000,180.000000,201.000000,204.000000,
188.000000,235.000000,227.000000,234.000000,264.000000,302.000000,293.000000,
259.000000,229.000000,203.000000,229.000000,242.000000,233.000000,267.000000,
269.000000,270.000000,315.000000,364.000000,347.000000,312.000000,274.000000,
237.000000,278.000000,284.000000,277.000000,317.000000,313.000000,318.000000,
374.000000,413.000000,405.000000,355.000000,306.000000,271.000000,306.000000,
315.000000,301.000000,356.000000,348.000000,355.000000,422.000000,465.000000,
467.000000,404.000000,347.000000,305.000000,336.000000,340.000000,318.000000,
362.000000,348.000000,363.000000,435.000000,491.000000,505.000000,404.000000,
359.000000,310.000000,337.000000,360.000000,342.000000,406.000000,396.000000,
420.000000,472.000000,548.000000,559.000000,463.000000,407.000000,362.000000,
405.000000,417.000000,391.000000,419.000000,461.000000,472.000000,535.000000,
622.000000,606.000000,508.000000,461.000000,390.000000,432.000000)

# Create a matrix with one column of BJ07 values.
mBJ07 <- matrix(dblHistorical_BJ07,
```

```

        ncol=1,
        dimnames=list(c(1:length(dblHistorical_BJ07)),c("BJ07")))

# Create a time series from the matrix.
tsBJ07 <- ts(mBJ07,start=c(1949,1),frequency=12)

# Set the S_5 historical values.
dblHistoricalValues_S_5 <- c(
5,1.6863,15.65859,12.64733,20.71753,34.20801,46.61443,38.06243,62.63438,
11.08147,39.50784,36.01477,13.37003,32.88305,13.61093,9.39516,6.98614,
2.52947,8.91335,9.39516,39.86919,51.79381,37.33973,7.46795,10.59966,
5.66118,4.93848,39.50784,2.77037,15.05634,41.3146,14.45409,0,
55.04598,36.49657,34.32846,41.7964,6.62479,11.32237,5.29983,
1.08406,2.16811,52.27562,4.09532,26.37871,21.19933,35.77387,26.25826,
7.10659,14.21319,7.22704,9.39516,13.85183,4.21578,8.91335,0,
4.33623,7.22704,14.33364,1.20451,22.28338,7.22704,3.61352,0.4818,
1.80676,36.97837,0,0,0,3.37262,12.88823)

# Create a matrix with one column of S_5 values.
mS_5 <- matrix(dblHistoricalValues_S_5,
        ncol=1,
        dimnames=list(c(1:length(dblHistoricalValues_S_5)),c("S_5")))

# Create a time series from the matrix.
tsS_5 <- ts(mS_5,start=c(1980,1),frequency=12)

# Make a list of 12 autobox objects.
listAutobox <- NULL
iIndex <- 1
for (i in 1:6)
{
    # Add a BJ07 autobox object.
    listAutobox[[iIndex]] <-
        autobox(tsBJ07,
            iDataType=c(0),
            iObjective=c(0,0,0),
            iNumberOfRetainedValues=0,
            iNumberOfForecastValues=12,
            cPath=".\\Output")
    iIndex <- iIndex + 1
    # Add a S-5 autobox object.
    listAutobox[[iIndex]] <-
        autobox(tsS_5,
            iDataType=c(0),
            iObjective=c(0,0,0),
            iNumberOfRetainedValues=0,
            iNumberOfForecastValues=33,
            cPath=".\\Output")
    iIndex <- iIndex + 1
}

# Save the current time.
ptime <- proc.time()

```

```
# Run the calculation sequentially on all the objects.
listAutobox <- lapply(listAutobox,autoboxRun)
```

```
# Display the elapsed time.
proc.time() - ptime
```

```
##      user  system elapsed
##    32.72   34.60   122.75
```

```
# Loop through the objects.
for (i in 1:length(listAutobox))
{
  # Print the status.
  print(listAutobox[[i]]$cStatus)
}
```

```
## [1] "BJ07: Autobox calculation complete, return code = 0."
## [1] "S_5: Autobox calculation complete, return code = 0."
## [1] "BJ07: Autobox calculation complete, return code = 0."
## [1] "S_5: Autobox calculation complete, return code = 0."
## [1] "BJ07: Autobox calculation complete, return code = 0."
## [1] "S_5: Autobox calculation complete, return code = 0."
## [1] "BJ07: Autobox calculation complete, return code = 0."
## [1] "S_5: Autobox calculation complete, return code = 0."
## [1] "BJ07: Autobox calculation complete, return code = 0."
## [1] "S_5: Autobox calculation complete, return code = 0."
## [1] "BJ07: Autobox calculation complete, return code = 0."
## [1] "S_5: Autobox calculation complete, return code = 0."
```

```
# Make a list of 12 autobox objects.
listAutobox <- NULL
iIndex <- 1
for (i in 1:6)
{
  # Add a BJ07 autobox object.
  listAutobox[[iIndex]] <-
    autobox(tsBJ07,
      iDataType=c(0),
      iObjective=c(0,0,0),
      iNumberOfRetainedValues=0,
      iNumberOfForecastValues=12,
      cPath=paste(".\\Output_BJ07", "_", i, sep=""))
  iIndex <- iIndex + 1
  # Add a S-5 autobox object.
  listAutobox[[iIndex]] <-
    autobox(tsS_5,
      iDataType=c(0),
      iObjective=c(0,0,0),
      iNumberOfRetainedValues=0,
      iNumberOfForecastValues=33,
      cPath=paste(".\\Output_S-5", "_", i, sep=""))
  iIndex <- iIndex + 1
}
```

```

}

# Save the current time.
ptime <- proc.time()

# Get the number of physical cores on this CPU.
cores <- detectCores(logical=FALSE)

# Print the number of physical cores.
paste("Number of cores =",cores)

## [1] "Number of cores = 2"

# Run the calculation in parallel on all the objects.
listAutobox <- autoboxRunInParallel(cores,listAutobox)

# Display the elapsed time.
proc.time() - ptime

```

```

##      user  system elapsed
##      0.02    0.00   99.80

```

```

# Loop through the objects.
for (i in 1:length(listAutobox))
{
  # Print the status.
  print(listAutobox[[i]]$cStatus)
}

```

```

## [1] "BJ07: Autobox calculation complete, return code = 0."
## [1] "S_5: Autobox calculation complete, return code = 0."
## [1] "BJ07: Autobox calculation complete, return code = 0."
## [1] "S_5: Autobox calculation complete, return code = 0."
## [1] "BJ07: Autobox calculation complete, return code = 0."
## [1] "S_5: Autobox calculation complete, return code = 0."
## [1] "BJ07: Autobox calculation complete, return code = 0."
## [1] "S_5: Autobox calculation complete, return code = 0."
## [1] "BJ07: Autobox calculation complete, return code = 0."
## [1] "S_5: Autobox calculation complete, return code = 0."
## [1] "BJ07: Autobox calculation complete, return code = 0."
## [1] "S_5: Autobox calculation complete, return code = 0."

```

```

# Print the results
# The selection parameter selects the values to print:
# a = Actual,
# c = Cleansed (Adjusted),
# e = Equations,
# f = Forecast,
# h = Historical,
# i = Interventions,
# r = Residual,

```

```

# s = Statistics,
# t = Fitted.
# Print the last 2 objects.
for (i in (length(listAutobox)-1):length(listAutobox))
{
  autoboxPrint(listAutobox[[i]],selection="acefirst")
}

```

```

## [1] "
## [2] " AUTOMATIC FORECASTING SYSTEMS
## [3] " HATBORO PA 19040
## [4] " 215-675-0652
## [5] " VERSION: 08/10/2017 16:33
## [6] "
## [7] "
## [8] "
## [9] "MODELLING OUTPUT SERIES:BJ07
## [10] "
## [11] "
## [12] "
## [13] "[ (1-B**12)]Y(T) = 6.0781 BJ07
## [14] " +[X1(T)][ (1-B**12)][ (- 43.5185)] :PULSE 1960/ 3 "
## [15] " +[X2(T)][ (1-B**12)][ (- 16.7624)] :PULSE 1958/ 9 "
## [16] " +[X3(T)][ (1-B**12)][ (+ 16.8083)] :PULSE 1952/ 6 "
## [17] " + [(1- 0.817B** 1)]** -1 [A(T)] BJ07
## [18] "
## [19] "
## [20] "
## [1] "BJ07 1949 1 12 4
## [2] " 1
## [3] " 0.6078D+01
## [4] " 0.1000D+01 0.0000D+00
## [5] " 1 1 0 0
## [6] " 12
## [7] " 1
## [8] " 1
## [9] " 0.8166D+00
## [10] "I~P00135BJ07
## [11] " 0.1000D+01 0.0000D+00
## [12] " 0 1 1 0
## [13] " 12
## [14] " 1
## [15] " 0
## [16] " -0.4352D+02
## [17] "I~P00117BJ07
## [18] " 0.1000D+01 0.0000D+00
## [19] " 0 1 1 0
## [20] " 12
## [21] " 1
## [22] " 0
## [23] " -0.1676D+02
## [24] "I~P00042BJ07
## [25] " 0.1000D+01 0.0000D+00

```

```

## [26] "      0      1      1      0
## [27] "      12
## [28] "       1
## [29] "       0
## [30] " 0.1681D+02
##      Period      Actual   Adjusted   Forecast LowerLimits UpperLimits
## 1      1949 1 112.00000 112.00000      NA          NA          NA
## 2      1949 2 118.00000 118.00000      NA          NA          NA
## 3      1949 3 132.00000 132.00000      NA          NA          NA
## 4      1949 4 129.00000 129.00000      NA          NA          NA
## 5      1949 5 121.00000 121.00000      NA          NA          NA
## 6      1949 6 135.00000 135.00000      NA          NA          NA
## 7      1949 7 148.00000 148.00000      NA          NA          NA
## 8      1949 8 148.00000 148.00000      NA          NA          NA
## 9      1949 9 136.00000 136.00000      NA          NA          NA
## 10     1949 10 119.00000 119.00000      NA          NA          NA
## 11     1949 11 104.00000 104.00000      NA          NA          NA
## 12     1949 12 118.00000 118.00000      NA          NA          NA
## 13     1950 1 115.00000 115.00000      NA          NA          NA
## 14     1950 2 126.00000 126.00000      NA          NA          NA
## 15     1950 3 141.00000 141.00000      NA          NA          NA
## 16     1950 4 135.00000 135.00000      NA          NA          NA
## 17     1950 5 125.00000 125.00000      NA          NA          NA
## 18     1950 6 149.00000 149.00000      NA          NA          NA
## 19     1950 7 170.00000 170.00000      NA          NA          NA
## 20     1950 8 170.00000 170.00000      NA          NA          NA
## 21     1950 9 158.00000 158.00000      NA          NA          NA
## 22     1950 10 133.00000 133.00000      NA          NA          NA
## 23     1950 11 114.00000 114.00000      NA          NA          NA
## 24     1950 12 140.00000 140.00000      NA          NA          NA
## 25     1951 1 145.00000 145.00000      NA          NA          NA
## 26     1951 2 150.00000 150.00000      NA          NA          NA
## 27     1951 3 178.00000 178.00000      NA          NA          NA
## 28     1951 4 163.00000 163.00000      NA          NA          NA
## 29     1951 5 172.00000 172.00000      NA          NA          NA
## 30     1951 6 178.00000 178.00000      NA          NA          NA
## 31     1951 7 199.00000 199.00000      NA          NA          NA
## 32     1951 8 199.00000 199.00000      NA          NA          NA
## 33     1951 9 184.00000 184.00000      NA          NA          NA
## 34     1951 10 162.00000 162.00000      NA          NA          NA
## 35     1951 11 146.00000 146.00000      NA          NA          NA
## 36     1951 12 166.00000 166.00000      NA          NA          NA
## 37     1952 1 171.00000 171.00000      NA          NA          NA
## 38     1952 2 180.00000 180.00000      NA          NA          NA
## 39     1952 3 193.00000 193.00000      NA          NA          NA
## 40     1952 4 181.00000 181.00000      NA          NA          NA
## 41     1952 5 183.00000 183.00000      NA          NA          NA
## 42     1952 6 218.00000 201.19171      NA          NA          NA
## 43     1952 7 230.00000 230.00000      NA          NA          NA
## 44     1952 8 242.00000 242.00000      NA          NA          NA
## 45     1952 9 209.00000 209.00000      NA          NA          NA
## 46     1952 10 191.00000 191.00000      NA          NA          NA
## 47     1952 11 172.00000 172.00000      NA          NA          NA
## 48     1952 12 194.00000 194.00000      NA          NA          NA

```

## 49	1953 1	196.00000	196.00000	NA	NA	NA
## 50	1953 2	196.00000	196.00000	NA	NA	NA
## 51	1953 3	236.00000	236.00000	NA	NA	NA
## 52	1953 4	235.00000	235.00000	NA	NA	NA
## 53	1953 5	229.00000	229.00000	NA	NA	NA
## 54	1953 6	243.00000	243.00000	NA	NA	NA
## 55	1953 7	264.00000	264.00000	NA	NA	NA
## 56	1953 8	272.00000	272.00000	NA	NA	NA
## 57	1953 9	237.00000	237.00000	NA	NA	NA
## 58	1953 10	211.00000	211.00000	NA	NA	NA
## 59	1953 11	180.00000	180.00000	NA	NA	NA
## 60	1953 12	201.00000	201.00000	NA	NA	NA
## 61	1954 1	204.00000	204.00000	NA	NA	NA
## 62	1954 2	188.00000	188.00000	NA	NA	NA
## 63	1954 3	235.00000	235.00000	NA	NA	NA
## 64	1954 4	227.00000	227.00000	NA	NA	NA
## 65	1954 5	234.00000	234.00000	NA	NA	NA
## 66	1954 6	264.00000	264.00000	NA	NA	NA
## 67	1954 7	302.00000	302.00000	NA	NA	NA
## 68	1954 8	293.00000	293.00000	NA	NA	NA
## 69	1954 9	259.00000	259.00000	NA	NA	NA
## 70	1954 10	229.00000	229.00000	NA	NA	NA
## 71	1954 11	203.00000	203.00000	NA	NA	NA
## 72	1954 12	229.00000	229.00000	NA	NA	NA
## 73	1955 1	242.00000	242.00000	NA	NA	NA
## 74	1955 2	233.00000	233.00000	NA	NA	NA
## 75	1955 3	267.00000	267.00000	NA	NA	NA
## 76	1955 4	269.00000	269.00000	NA	NA	NA
## 77	1955 5	270.00000	270.00000	NA	NA	NA
## 78	1955 6	315.00000	315.00000	NA	NA	NA
## 79	1955 7	364.00000	364.00000	NA	NA	NA
## 80	1955 8	347.00000	347.00000	NA	NA	NA
## 81	1955 9	312.00000	312.00000	NA	NA	NA
## 82	1955 10	274.00000	274.00000	NA	NA	NA
## 83	1955 11	237.00000	237.00000	NA	NA	NA
## 84	1955 12	278.00000	278.00000	NA	NA	NA
## 85	1956 1	284.00000	284.00000	NA	NA	NA
## 86	1956 2	277.00000	277.00000	NA	NA	NA
## 87	1956 3	317.00000	317.00000	NA	NA	NA
## 88	1956 4	313.00000	313.00000	NA	NA	NA
## 89	1956 5	318.00000	318.00000	NA	NA	NA
## 90	1956 6	374.00000	374.00000	NA	NA	NA
## 91	1956 7	413.00000	413.00000	NA	NA	NA
## 92	1956 8	405.00000	405.00000	NA	NA	NA
## 93	1956 9	355.00000	355.00000	NA	NA	NA
## 94	1956 10	306.00000	306.00000	NA	NA	NA
## 95	1956 11	271.00000	271.00000	NA	NA	NA
## 96	1956 12	306.00000	306.00000	NA	NA	NA
## 97	1957 1	315.00000	315.00000	NA	NA	NA
## 98	1957 2	301.00000	301.00000	NA	NA	NA
## 99	1957 3	356.00000	356.00000	NA	NA	NA
## 100	1957 4	348.00000	348.00000	NA	NA	NA
## 101	1957 5	355.00000	355.00000	NA	NA	NA
## 102	1957 6	422.00000	422.00000	NA	NA	NA

## 103	1957 7	465.00000	465.00000	NA	NA	NA
## 104	1957 8	467.00000	467.00000	NA	NA	NA
## 105	1957 9	404.00000	404.00000	NA	NA	NA
## 106	1957 10	347.00000	347.00000	NA	NA	NA
## 107	1957 11	305.00000	305.00000	NA	NA	NA
## 108	1957 12	336.00000	336.00000	NA	NA	NA
## 109	1958 1	340.00000	340.00000	NA	NA	NA
## 110	1958 2	318.00000	318.00000	NA	NA	NA
## 111	1958 3	362.00000	362.00000	NA	NA	NA
## 112	1958 4	348.00000	348.00000	NA	NA	NA
## 113	1958 5	363.00000	363.00000	NA	NA	NA
## 114	1958 6	435.00000	435.00000	NA	NA	NA
## 115	1958 7	491.00000	491.00000	NA	NA	NA
## 116	1958 8	505.00000	505.00000	NA	NA	NA
## 117	1958 9	404.00000	420.76236	NA	NA	NA
## 118	1958 10	359.00000	359.00000	NA	NA	NA
## 119	1958 11	310.00000	310.00000	NA	NA	NA
## 120	1958 12	337.00000	337.00000	NA	NA	NA
## 121	1959 1	360.00000	360.00000	NA	NA	NA
## 122	1959 2	342.00000	342.00000	NA	NA	NA
## 123	1959 3	406.00000	406.00000	NA	NA	NA
## 124	1959 4	396.00000	396.00000	NA	NA	NA
## 125	1959 5	420.00000	420.00000	NA	NA	NA
## 126	1959 6	472.00000	472.00000	NA	NA	NA
## 127	1959 7	548.00000	548.00000	NA	NA	NA
## 128	1959 8	559.00000	559.00000	NA	NA	NA
## 129	1959 9	463.00000	463.00000	NA	NA	NA
## 130	1959 10	407.00000	407.00000	NA	NA	NA
## 131	1959 11	362.00000	362.00000	NA	NA	NA
## 132	1959 12	405.00000	405.00000	NA	NA	NA
## 133	1960 1	417.00000	417.00000	NA	NA	NA
## 134	1960 2	391.00000	391.00000	NA	NA	NA
## 135	1960 3	419.00000	462.51847	NA	NA	NA
## 136	1960 4	461.00000	461.00000	NA	NA	NA
## 137	1960 5	472.00000	472.00000	NA	NA	NA
## 138	1960 6	535.00000	535.00000	NA	NA	NA
## 139	1960 7	622.00000	622.00000	NA	NA	NA
## 140	1960 8	606.00000	606.00000	NA	NA	NA
## 141	1960 9	508.00000	508.00000	NA	NA	NA
## 142	1960 10	461.00000	461.00000	NA	NA	NA
## 143	1960 11	390.00000	390.00000	NA	NA	NA
## 144	1960 12	432.00000	432.00000	NA	NA	NA
## 145	1961 1	NA	NA 445.00000	425.00000	465.00000	
## 146	1961 2	NA	NA 420.00000	392.00000	445.00000	
## 147	1961 3	NA	NA 492.00000	465.00000	520.00000	
## 148	1961 4	NA	NA 491.00000	460.00000	522.00000	
## 149	1961 5	NA	NA 503.00000	468.00000	536.00000	
## 150	1961 6	NA	NA 566.00000	533.00000	600.00000	
## 151	1961 7	NA	NA 654.00000	617.00000	685.00000	
## 152	1961 8	NA	NA 638.00000	603.00000	671.00000	
## 153	1961 9	NA	NA 540.00000	505.00000	574.00000	
## 154	1961 10	NA	NA 493.00000	457.00000	526.00000	
## 155	1961 11	NA	NA 422.00000	387.00000	456.00000	
## 156	1961 12	NA	NA 465.00000	427.00000	499.00000	

##	BJ07 Interventions	Residuals	Fitted
## 1	112.00000	0.00000	112.00000
## 2	118.00000	0.00000	118.00000
## 3	132.00000	0.00000	132.00000
## 4	129.00000	0.00000	129.00000
## 5	121.00000	0.00000	121.00000
## 6	135.00000	0.00000	135.00000
## 7	148.00000	0.00000	148.00000
## 8	148.00000	0.00000	148.00000
## 9	136.00000	0.00000	136.00000
## 10	119.00000	0.00000	119.00000
## 11	104.00000	0.00000	104.00000
## 12	118.00000	0.00000	118.00000
## 13	115.00000	0.00000	115.00000
## 14	126.00000	-0.52790	126.52790
## 15	141.00000	-3.61087	144.61087
## 16	135.00000	-7.42746	142.42746
## 17	125.00000	-6.97768	131.97768
## 18	149.00000	4.65551	144.34449
## 19	170.00000	4.48956	165.51044
## 20	170.00000	-2.04319	172.04319
## 21	158.00000	-2.04319	160.04319
## 22	133.00000	-10.04319	143.04319
## 23	114.00000	-7.51044	121.51044
## 24	140.00000	7.75594	132.24406
## 25	145.00000	5.95681	139.04319
## 26	150.00000	-6.57595	156.57595
## 27	178.00000	11.32362	166.67638
## 28	163.00000	-8.29211	171.29211
## 29	172.00000	18.05724	153.94276
## 30	178.00000	-15.45805	193.45805
## 31	199.00000	-0.75935	199.75935
## 32	199.00000	-0.75935	199.75935
## 33	184.00000	-3.75935	187.75935
## 34	162.00000	1.69043	160.30957
## 35	146.00000	2.24065	143.75935
## 36	166.00000	-6.20913	172.20913
## 37	171.00000	-1.30957	172.30957
## 38	180.00000	2.69043	177.30957
## 39	193.00000	-15.57595	208.57595
## 40	181.00000	-0.32703	181.32703
## 41	183.00000	-9.77681	192.77681
## 42	218.00000	Pulse 16.81 8.13105	209.86895
## 43	230.00000	5.98367	224.01633
## 44	242.00000	11.60746	230.39254
## 45	209.00000	-16.19167	225.19167
## 46	191.00000	2.50703	188.49297
## 47	172.00000	-3.75935	175.75935
## 48	194.00000	0.69043	193.30957
## 49	196.00000	-3.94276	199.94276
## 50	196.00000	-10.49297	206.49297
## 51	236.00000	23.85638	212.14362
## 52	235.00000	12.80833	222.19167
## 53	229.00000	-4.17421	233.17421

## 54	243.00000	-1.83316	244.83316
## 55	264.00000	-6.21853	270.21853
## 56	272.00000	-3.84232	275.84232
## 57	237.00000	-2.57595	239.57595
## 58	211.00000	-8.94276	219.94276
## 59	180.00000	-14.41000	194.41000
## 60	201.00000	-5.61087	206.61087
## 61	204.00000	-3.79428	207.79428
## 62	188.00000	-20.61087	208.61087
## 63	235.00000	-0.54536	235.54536
## 64	227.00000	-13.26152	240.26152
## 65	234.00000	5.45464	228.54536
## 66	264.00000	10.83891	253.16109
## 67	302.00000	14.77340	287.22660
## 68	293.00000	-16.10870	309.10870
## 69	259.00000	-1.22660	260.22660
## 70	229.00000	-6.04319	235.04319
## 71	203.00000	2.22319	200.77681
## 72	229.00000	3.14022	225.85978
## 73	242.00000	9.05724	232.94276
## 74	233.00000	7.89130	225.10870
## 75	267.00000	-10.82486	277.82486
## 76	269.00000	9.79087	259.20913
## 77	270.00000	-4.37508	274.37508
## 78	315.00000	15.52449	299.47551
## 79	364.00000	14.27557	349.72443
## 80	347.00000	-2.70696	349.70696
## 81	312.00000	2.82579	309.17421
## 82	274.00000	-4.35761	278.35761
## 83	237.00000	-8.82486	245.82486
## 84	278.00000	15.15768	262.84232
## 85	284.00000	-4.09124	288.09124
## 86	277.00000	3.62492	273.37508
## 87	317.00000	7.99173	309.00827
## 88	313.00000	-2.90783	315.90783
## 89	318.00000	5.99173	312.00827
## 90	374.00000	13.72536	360.27464
## 91	413.00000	-5.25718	418.25718
## 92	405.00000	11.90876	393.09124
## 93	355.00000	-10.44059	365.44059
## 94	306.00000	-9.19167	315.19167
## 95	271.00000	1.79087	269.20913
## 96	306.00000	-5.84232	311.84232
## 97	315.00000	2.05724	312.94276
## 98	301.00000	-7.39254	308.39254
## 99	356.00000	13.32362	342.67638
## 100	348.00000	-2.92529	350.92529
## 101	355.00000	2.34108	352.65892
## 102	422.00000	11.70789	410.29211
## 103	465.00000	6.72536	458.27464
## 104	467.00000	13.45898	453.54102
## 105	404.00000	-7.70696	411.70696
## 106	347.00000	-5.09124	352.09124
## 107	305.00000	-5.55848	310.55848

## 108	336.00000		-3.84232	339.84232
## 109	340.00000		-5.57595	345.57595
## 110	318.00000		-9.49297	327.49297
## 111	362.00000		-13.96022	375.96022
## 112	348.00000		-10.97768	358.97768
## 113	363.00000		1.92188	361.07812
## 114	435.00000		0.38913	434.61087
## 115	491.00000		9.30616	481.69384
## 116	505.00000		10.69043	494.30957
## 117	404.00000	Pulse -16.76	-20.34634	424.34634
## 118	359.00000		-7.76616	366.76616
## 119	310.00000		-10.87725	320.87725
## 120	337.00000		-9.16109	346.16109
## 121	360.00000		13.10529	346.89471
## 122	342.00000		1.59000	340.41000
## 123	406.00000		18.32362	387.67638
## 124	396.00000		5.99173	390.00827
## 125	420.00000		11.72536	408.27464
## 126	472.00000		-15.62399	487.62399
## 127	548.00000		20.70789	527.29211
## 128	559.00000		1.37601	557.62399
## 129	463.00000		-7.93657	470.93657
## 130	407.00000		7.43087	399.56913
## 131	362.00000		6.72536	355.27464
## 132	405.00000		19.45898	385.54102
## 133	417.00000		-4.60653	421.60653
## 134	391.00000		-3.62399	394.62399
## 135	419.00000	Pulse -43.52	10.42724	408.57276
## 136	461.00000		12.76922	448.23078
## 137	472.00000		-7.15675	479.15675
## 138	535.00000		14.45898	520.54102
## 139	622.00000		16.47644	605.52356
## 140	606.00000		-19.50609	625.50609
## 141	508.00000		0.54195	507.45805
## 142	461.00000		11.17514	449.82486
## 143	390.00000		-22.17421	412.17421
## 144	432.00000		-1.94276	433.94276
## 145	NA		NA	NA
## 146	NA		NA	NA
## 147	NA		NA	NA
## 148	NA		NA	NA
## 149	NA		NA	NA
## 150	NA		NA	NA
## 151	NA		NA	NA
## 152	NA		NA	NA
## 153	NA		NA	NA
## 154	NA		NA	NA
## 155	NA		NA	NA
## 156	NA		NA	NA
##			Statistic	Value
## 1			RSQ	9.927691e-01
## 2			RMSE (VARIANCE OF ERRORS)	9.919612e+00
## 3			STD DEV OF ERRORS	0.000000e+00
## 4			MAPE	2.678825e-02

```

## 5                                SUM OF FORECASTS 6.129000e+03
## 6                                DAYS LEFT IN TRIAL PERIOD 8.000000e+00
## 7                                NOT ACTIVE 0.000000e+00
## 8                                FORECAST CONFIDENCE INTERVAL 9.500000e+01
## 9                                SUM OF SQUARES OF RESIDUALS 1.239824e+04
## 10                               DEGREES OF FREEDOM FOR MODEL 1.260000e+02
## 11                               NUMBER OF PARAMETERS IN MODEL 5.000000e+00
## 12 SEASONAL INDICATOR (1 IF THERE ARE ANY SEASONAL ELEMENTS) 1.000000e+00
## 13                               NULL 0.000000e+00
## [1] "
## [2] " AUTOMATIC FORECASTING SYSTEMS
## [3] " HATBORO PA 19040
## [4] " 215-675-0652
## [5] " VERSION: 08/10/2017 16:33
## [6] "
## [7] "
## [8] "
## [9] "MODELLING OUTPUT SERIES:S_5
## [10] "
## [11] "
## [12] "
## [13] "Y(T) = 22.538 S_5
## [14] " +[X1(T)][(+ 47.4782)] :PULSE 1983/ 7 43 I~ "
## [15] " +[X2(T)][(+ 38.7454)] :PULSE 1980/ 9 9 I~ "
## [16] " +[X3(T)][(+ 35.3559)] :PULSE 1982/ 10 34 I~ "
## [17] " +[X4(T)][(- 14.4616)] :LEVEL SHIFT 1983/ 2 38 I~ "
## [18] " +[X5(T)][(+ 33.6582)] :PULSE 1985/ 6 66 I~ "
## [19] " + [(1- 0.379B** 1)]**-1 [A(T)] S_5
## [20] "
## [1] "S_5 1980 1 12 6
## [2] " 1
## [3] " 0.1399D+02
## [4] " 0.1000D+01 0.0000D+00
## [5] " 1 0 0 0
## [6] " 1
## [7] " 1
## [8] " 0.3793D+00
## [9] "I~P00043S_5
## [10] " 0.1000D+01 0.0000D+00
## [11] " 0 0 1 0
## [12] " 1
## [13] " 0
## [14] " 0.4748D+02
## [15] "I~P00009S_5
## [16] " 0.1000D+01 0.0000D+00
## [17] " 0 0 1 0
## [18] " 1
## [19] " 0
## [20] " 0.3875D+02
## [21] "I~P00034S_5
## [22] " 0.1000D+01 0.0000D+00
## [23] " 0 0 1 0
## [24] " 1
## [25] " 0

```

```

## [26] " 0.3536D+02
## [27] "I~L00038S_5
## [28] " 0.1000D+01 0.0000D+00
## [29] "      0      0      1      0
## [30] "      1
## [31] "      0
## [32] " -0.1446D+02
## [33] "I~P00066S_5
## [34] " 0.1000D+01 0.0000D+00
## [35] "      0      0      1      0
## [36] "      1
## [37] "      0
## [38] " 0.3366D+02
##      Period   Actual Adjusted Forecast LowerLimits UpperLimits      S_5
## 1  1980 1  5.00000  5.00000      NA      NA      NA  5.00000
## 2  1980 2  1.68630  1.68630      NA      NA      NA  1.68630
## 3  1980 3 15.65859 15.65859      NA      NA      NA 15.65859
## 4  1980 4 12.64733 12.64733      NA      NA      NA 12.64733
## 5  1980 5 20.71753 20.71753      NA      NA      NA 20.71753
## 6  1980 6 34.20801 34.20801      NA      NA      NA 34.20801
## 7  1980 7 46.61443 46.61443      NA      NA      NA 46.61443
## 8  1980 8 38.06243 38.06243      NA      NA      NA 38.06243
## 9  1980 9 62.63438 23.88897      NA      NA      NA 62.63438
## 10 1980 10 11.08147 11.08147      NA      NA      NA 11.08147
## 11 1980 11 39.50784 39.50784      NA      NA      NA 39.50784
## 12 1980 12 36.01477 36.01477      NA      NA      NA 36.01477
## 13 1981 1 13.37003 13.37003      NA      NA      NA 13.37003
## 14 1981 2 32.88305 32.88305      NA      NA      NA 32.88305
## 15 1981 3 13.61093 13.61093      NA      NA      NA 13.61093
## 16 1981 4  9.39516  9.39516      NA      NA      NA  9.39516
## 17 1981 5  6.98614  6.98614      NA      NA      NA  6.98614
## 18 1981 6  2.52947  2.52947      NA      NA      NA  2.52947
## 19 1981 7  8.91335  8.91335      NA      NA      NA  8.91335
## 20 1981 8  9.39516  9.39516      NA      NA      NA  9.39516
## 21 1981 9 39.86919 39.86919      NA      NA      NA 39.86919
## 22 1981 10 51.79381 51.79381      NA      NA      NA 51.79381
## 23 1981 11 37.33973 37.33973      NA      NA      NA 37.33973
## 24 1981 12  7.46795  7.46795      NA      NA      NA  7.46795
## 25 1982 1 10.59966 10.59966      NA      NA      NA 10.59966
## 26 1982 2  5.66118  5.66118      NA      NA      NA  5.66118
## 27 1982 3  4.93848  4.93848      NA      NA      NA  4.93848
## 28 1982 4 39.50784 39.50784      NA      NA      NA 39.50784
## 29 1982 5  2.77037  2.77037      NA      NA      NA  2.77037
## 30 1982 6 15.05634 15.05634      NA      NA      NA 15.05634
## 31 1982 7 41.31460 41.31460      NA      NA      NA 41.31460
## 32 1982 8 14.45409 14.45409      NA      NA      NA 14.45409
## 33 1982 9  0.00000  0.00000      NA      NA      NA  0.00000
## 34 1982 10 55.04598 19.69005      NA      NA      NA 55.04598
## 35 1982 11 36.49657 36.49657      NA      NA      NA 36.49657
## 36 1982 12 34.32846 34.32846      NA      NA      NA 34.32846
## 37 1983 1 41.79640 41.79640      NA      NA      NA 41.79640
## 38 1983 2  6.62479 21.08642      NA      NA      NA  6.62479
## 39 1983 3 11.32237 25.78400      NA      NA      NA 11.32237
## 40 1983 4  5.29983 19.76146      NA      NA      NA  5.29983

```

## 41	1983 5	1.08406	15.54569	NA	NA	NA	1.08406
## 42	1983 6	2.16811	16.62974	NA	NA	NA	2.16811
## 43	1983 7	52.27562	19.25903	NA	NA	NA	52.27562
## 44	1983 8	4.09532	18.55695	NA	NA	NA	4.09532
## 45	1983 9	26.37871	40.84034	NA	NA	NA	26.37871
## 46	1983 10	21.19933	35.66096	NA	NA	NA	21.19933
## 47	1983 11	35.77387	50.23550	NA	NA	NA	35.77387
## 48	1983 12	26.25826	40.71989	NA	NA	NA	26.25826
## 49	1984 1	7.10659	21.56822	NA	NA	NA	7.10659
## 50	1984 2	14.21319	28.67482	NA	NA	NA	14.21319
## 51	1984 3	7.22704	21.68867	NA	NA	NA	7.22704
## 52	1984 4	9.39516	23.85679	NA	NA	NA	9.39516
## 53	1984 5	13.85183	28.31346	NA	NA	NA	13.85183
## 54	1984 6	4.21578	18.67741	NA	NA	NA	4.21578
## 55	1984 7	8.91335	23.37498	NA	NA	NA	8.91335
## 56	1984 8	0.00000	14.46163	NA	NA	NA	0.00000
## 57	1984 9	4.33623	18.79786	NA	NA	NA	4.33623
## 58	1984 10	7.22704	21.68867	NA	NA	NA	7.22704
## 59	1984 11	14.33364	28.79527	NA	NA	NA	14.33364
## 60	1984 12	1.20451	15.66614	NA	NA	NA	1.20451
## 61	1985 1	22.28338	36.74501	NA	NA	NA	22.28338
## 62	1985 2	7.22704	21.68867	NA	NA	NA	7.22704
## 63	1985 3	3.61352	18.07515	NA	NA	NA	3.61352
## 64	1985 4	0.48180	14.94343	NA	NA	NA	0.48180
## 65	1985 5	1.80676	16.26839	NA	NA	NA	1.80676
## 66	1985 6	36.97837	17.78182	NA	NA	NA	36.97837
## 67	1985 7	0.00000	14.46163	NA	NA	NA	0.00000
## 68	1985 8	0.00000	14.46163	NA	NA	NA	0.00000
## 69	1985 9	0.00000	14.46163	NA	NA	NA	0.00000
## 70	1985 10	3.37262	17.83425	NA	NA	NA	3.37262
## 71	1985 11	12.88823	27.34986	NA	NA	NA	12.88823
## 72	1985 12	NA	NA	9.90100	0.00000	48.61800	NA
## 73	1986 1	NA	NA	8.76800	0.00000	42.86800	NA
## 74	1986 2	NA	NA	8.33900	0.00000	43.54000	NA
## 75	1986 3	NA	NA	8.17600	0.00000	42.84700	NA
## 76	1986 4	NA	NA	8.11400	0.00000	50.61900	NA
## 77	1986 5	NA	NA	8.09000	0.00000	43.23600	NA
## 78	1986 6	NA	NA	8.08100	0.00000	43.00600	NA
## 79	1986 7	NA	NA	8.07800	0.00000	49.28500	NA
## 80	1986 8	NA	NA	8.07700	0.00000	50.17600	NA
## 81	1986 9	NA	NA	8.07600	0.00000	49.16800	NA
## 82	1986 10	NA	NA	8.07600	0.00000	49.24800	NA
## 83	1986 11	NA	NA	8.07600	0.00000	49.71400	NA
## 84	1986 12	NA	NA	8.07600	0.00000	50.58100	NA
## 85	1987 1	NA	NA	8.07600	0.00000	49.75600	NA
## 86	1987 2	NA	NA	8.07600	0.00000	42.86000	NA
## 87	1987 3	NA	NA	8.07600	0.00000	43.75200	NA
## 88	1987 4	NA	NA	8.07600	0.00000	49.91400	NA
## 89	1987 5	NA	NA	8.07600	0.00000	43.72600	NA
## 90	1987 6	NA	NA	8.07600	0.00000	43.18400	NA
## 91	1987 7	NA	NA	8.07600	0.00000	51.01100	NA
## 92	1987 8	NA	NA	8.07600	0.00000	49.74800	NA
## 93	1987 9	NA	NA	8.07600	0.00000	43.09300	NA
## 94	1987 10	NA	NA	8.07600	0.00000	49.99200	NA

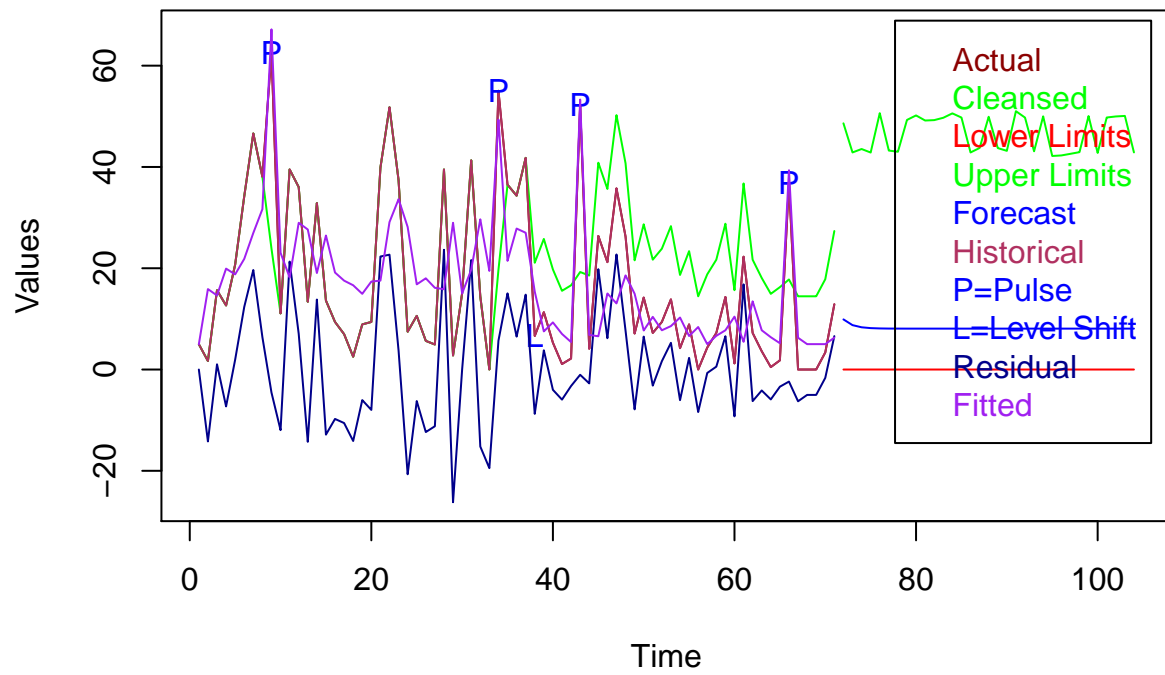
## 95	1987 11	NA	NA	8.07600	0.00000	42.16700	NA
## 96	1987 12	NA	NA	8.07600	0.00000	42.27200	NA
## 97	1988 1	NA	NA	8.07600	0.00000	42.59400	NA
## 98	1988 2	NA	NA	8.07600	0.00000	42.92400	NA
## 99	1988 3	NA	NA	8.07600	0.00000	50.05000	NA
## 100	1988 4	NA	NA	8.07600	0.00000	42.77200	NA
## 101	1988 5	NA	NA	8.07600	0.00000	49.76300	NA
## 102	1988 6	NA	NA	8.07600	0.00000	49.96900	NA
## 103	1988 7	NA	NA	8.07600	0.00000	50.07600	NA
## 104	1988 8	NA	NA	8.07600	0.00000	42.87400	NA
##	Interventions	Residuals	Fitted				
## 1		0.00000	5.00000				
## 2		-14.19890	15.88520				
## 3		1.03035	14.62824				
## 4		-7.28089	19.92822				
## 5		1.93154	18.78599				
## 6		12.36083	21.84718				
## 7		19.65003	26.96440				
## 8		6.39201	31.67042				
## 9	Pulse 38.75	-4.53749	67.17187				
## 10		-11.96871	23.05018				
## 11		21.31582	18.19202				
## 12		7.04003	28.97474				
## 13		-14.27971	27.64974				
## 14		13.82293	19.06012				
## 15		-12.85089	26.46182				
## 16		-9.75634	19.15150				
## 17		-10.56623	17.55237				
## 18		-14.10911	16.63858				
## 19		-6.03472	14.94807				
## 20		-7.97445	17.36961				
## 21		22.31682	17.55237				
## 22		22.68200	29.11181				
## 23		3.70467	33.63506				
## 24		-20.68438	28.15233				
## 25		-6.22168	16.82134				
## 26		-12.34808	18.00926				
## 27		-11.19751	16.13599				
## 28		23.64598	15.86186				
## 29		-26.20437	28.97474				
## 30		0.01689	15.03945				
## 31		21.61483	19.69977				
## 32		-15.20599	29.66008				
## 33		-19.47133	19.47133				
## 34	Pulse 35.35	5.70146	49.34452				
## 35		15.03913	21.45744				
## 36		6.49596	27.83250				
## 37		14.78631	27.01009				
## 38	Level Shift -14.46	-8.75642	15.38121				
## 39		3.79689	7.52548				
## 40		-4.00754	9.30737				
## 41		-5.93883	7.02289				
## 42		-3.25565	5.42376				
## 43	Pulse 47.48	-1.03757	53.31319				

## 44		-2.73699	6.83231
## 45		19.81271	6.56600
## 46		6.18078	15.01855
## 47		22.71996	13.05391
## 48		7.67593	18.58233
## 49		-7.86627	14.97286
## 50		6.50495	7.70824
## 51		-3.17688	10.40392
## 52		1.64124	7.75392
## 53		5.27549	8.57634
## 54		-6.05107	10.26685
## 55		2.30166	6.61169
## 56		-8.39358	8.39358
## 57		-0.67633	5.01256
## 58		0.56966	6.65738
## 59		6.57972	7.75392
## 60		-9.24510	10.44961
## 61		16.81393	5.46945
## 62		-6.23807	13.46511
## 63		-4.14040	7.75392
## 64		-5.90144	6.38324
## 65		-3.38855	5.19531
## 66	Pulse 33.66	-2.37771	39.35608
## 67		-6.27198	6.27198
## 68		-5.01256	5.01256
## 69		-5.01256	5.01256
## 70		-1.63994	5.01256
## 71		6.59637	6.29186
## 72		NA	NA
## 73		NA	NA
## 74		NA	NA
## 75		NA	NA
## 76		NA	NA
## 77		NA	NA
## 78		NA	NA
## 79		NA	NA
## 80		NA	NA
## 81		NA	NA
## 82		NA	NA
## 83		NA	NA
## 84		NA	NA
## 85		NA	NA
## 86		NA	NA
## 87		NA	NA
## 88		NA	NA
## 89		NA	NA
## 90		NA	NA
## 91		NA	NA
## 92		NA	NA
## 93		NA	NA
## 94		NA	NA
## 95		NA	NA
## 96		NA	NA
## 97		NA	NA


```
## 98      NA      NA
## 99      NA      NA
## 100     NA      NA
## 101     NA      NA
## 102     NA      NA
## 103     NA      NA
## 104     NA      NA
##
##                               Statistic      Value
## 1                               RSQ      0.5068958
## 2                     RMSE (VARIANCE OF ERRORS) 12.1284115
## 3                      STD DEV OF ERRORS      0.0000000
## 4                               MAPE      1.2435137
## 5                      SUM OF FORECASTS 269.4480000
## 6          DAYS LEFT IN TRIAL PERIOD 14.0000000
## 7                      NOT ACTIVE      0.0000000
## 8          FORECAST CONFIDENCE INTERVAL 95.0000000
## 9          SUM OF SQUARES OF RESIDUALS 9267.1969778
## 10         DEGREES OF FREEDOM FOR MODEL 63.0000000
## 11         NUMBER OF PARAMETERS IN MODEL 7.0000000
## 12 SEASONAL INDICATOR (1 IF THERE ARE ANY SEASONAL ELEMENTS) 0.0000000
## 13                               NULL      0.0000000
```

```
# Plot the result.
# The selection parameter selects the values to plot:
# a = Actual,
# c = Cleansed (Adjusted),
# f = Forecast,
# h = Historical,
# i = Interventions,
# n = Retained,
# r = Residual,
# t = Fitted,
# u = Future.
# Just plot the last object.
autoboxPlot(listAutobox[[length(listAutobox)]],selection="acfhinrtu")
```

S_5



```
# Unload the parallel library.
unloadNamespace("parallel")

# Unload the autobox library.
unloadNamespace("autobox")

# Restore the working directory.
setwd(saveWd)
```