Methods for Choosing Predictors

Alyssa Warnock, Helen Johnston, Ashley Wade, Hunter Barbee

11/28/2021

Consider the SleepStudy file described on Sakai. In this exercise, you will consider models to predict Grade Point Average (GPA) using any of the predictors.

```
sleep <- read.csv("https://raw.githubusercontent.com/JA-
McLean/STOR455/master/data/SleepStudy.csv")

source("https://raw.githubusercontent.com/JA-
McLean/STOR455/master/scripts/ShowSubsets.R")

Full=lm(GPA~factor(Gender)+factor(ClassYear)+factor(EarlyClass) + LarkOwl +
NumEarlyClass + ClassesMissed + CognitionZscore + PoorSleepQuality +
DepressionScore + AnxietyScore + StressScore + DepressionStatus +
AnxietyStatus + Stress + DASScore + Happiness + AlcoholUse + Drinks +
WeekdayBed + WeekdayRise + WeekdaySleep + WeekendBed + WeekendRise +
WeekendSleep + AverageSleep + AllNighter, data=sleep)
```

Use forward selection until you have a model for GPA.

```
none=lm(GPA~1,data=sleep)

MSE=(summary(Full)$sigma)^2
   #Specify the direction
step(none,scope=list(upper=Full),scale=MSE, direction= "forward", trace =
FALSE)

##
## Call:
## lm(formula = GPA ~ factor(ClassYear) + Drinks + CognitionZscore +
##     StressScore + DASScore, data = sleep)
##
## Coefficients:
##        (Intercept)  factor(ClassYear)2  factor(ClassYear)3
factor(ClassYear)4
##            3.52431            -0.34090            -0.33396            -
0.29771
##             Drinks     CognitionZscore         StressScore
DASScore
##           -0.01598             0.12020             0.03682            -
0.01366
```

Use backwards elimination until you have a model for GPA.

```
Full=lm(GPA~factor(Gender)+factor(ClassYear)+factor(EarlyClass) + LarkOwl +
NumEarlyClass + ClassesMissed + CognitionZscore + PoorSleepQuality +
DepressionScore + AnxietyScore + StressScore + DepressionStatus +
AnxietyStatus + Stress + DASScore + Happiness + AlcoholUse + Drinks +
WeekdayBed + WeekdayRise + WeekdaySleep + WeekendBed + WeekendRise +
WeekendSleep + AverageSleep + AllNighter, data=sleep)
# Find the MSE for the full model

MSE=(summary(Full)$sigma)^2
# Backward: use the step( ) command starting with the full model
#MSE = variance of the residuals

step(Full,scale=MSE, trace = FALSE)

##
## Call:
## lm(formula = GPA ~ factor(ClassYear) + CognitionZscore + DepressionScore +
##     AnxietyScore + StressScore + Drinks, data = sleep)
##
## Coefficients:
##        (Intercept)  factor(ClassYear)2  factor(ClassYear)3
factor(ClassYear)4
##            3.52494            -0.33946            -0.33128            -
0.29517
##    CognitionZscore     DepressionScore        AnxietyScore
StressScore
##            0.12009            -0.01182            -0.01642
0.02354
##             Drinks
##           -0.01610
```

Use a “best subsets” procedure to determine which predictors would explain the most variability in GPA.

```
source("https://raw.githubusercontent.com/JA-
McLean/STOR455/master/scripts/ShowSubsets.R")
library(leaps)
all=regsubsets(GPA~factor(Gender)+factor(ClassYear)+factor(EarlyClass) +
LarkOwl + NumEarlyClass + ClassesMissed + CognitionZscore + PoorSleepQuality
+ DepressionScore + AnxietyScore + StressScore + DepressionStatus +
AnxietyStatus + Stress + DASScore + Happiness + AlcoholUse + Drinks +
WeekdayBed + WeekdayRise + WeekdaySleep + WeekendBed + WeekendRise +
WeekendSleep + AverageSleep + AllNighter, data= sleep, nvmax=26)

## Warning in leaps.setup(x, y, wt = wt, nbest = nbest, nvmax = nvmax,
force.in =
## force.in, : 1 linear dependencies found

## Reordering variables and trying again:

ShowSubsets(all)
```

```
##           factor(Gender)1 factor(ClassYear)2 factor(ClassYear)3
## 1  ( 1 )                                                       
## 2  ( 1 )                                                       
## 3  ( 1 )                                                       
## 4  ( 1 )                                                       
## 5  ( 1 )                                   *                 *
## 6  ( 1 )                                   *                 *
## 7  ( 1 )                                   *                 *
## 8  ( 1 )                                   *                 *
## 9  ( 1 )                                   *                 *
## 10  ( 1 )                                  *                 *
## 11  ( 1 )                                  *                 *
## 12  ( 1 )                                  *                 *
## 13  ( 1 )                                  *                 *
## 14  ( 1 )                                  *                 *
## 15  ( 1 )                                  *                 *
## 16  ( 1 )                                  *                 *
## 17  ( 1 )                                  *                 *
## 18  ( 1 )                                  *                 *
## 19  ( 1 )                                  *                 *
## 20  ( 1 )                                  *                 *
## 21  ( 1 )                                  *                 *
## 22  ( 1 )                                  *                 *
## 23  ( 1 )                                  *                 *
## 24  ( 1 )                                  *                 *
## 25  ( 1 )                                  *                 *
## 26  ( 1 )                                  *                 *
## 27  ( 1 )                                  *                 *
##           factor(ClassYear)4 factor(EarlyClass)1 LarkOwlNeither LarkOwlOwl
## 1  ( 1 )                                                                  
## 2  ( 1 )                                                                  
## 3  ( 1 )                                                                  
## 4  ( 1 )                                                                  
## 5  ( 1 )                  *                                               
## 6  ( 1 )                  *                                               
## 7  ( 1 )                  *                                               
## 8  ( 1 )                  *                                            *  
## 9  ( 1 )                  *                                            *  
## 10  ( 1 )                 *                                            *  
## 11  ( 1 )                 *                                            *  
## 12  ( 1 )                 *                                            *  
## 13  ( 1 )                 *                                            *  
## 14  ( 1 )                 *                                            *  
## 15  ( 1 )                 *                                            *  
## 16  ( 1 )                 *                                            *  
## 17  ( 1 )                 *                                            *  
## 18  ( 1 )                 *                                            *  
## 19  ( 1 )                 *                    *                       *  
## 20  ( 1 )                 *                    *                       *  
## 21  ( 1 )                 *                    *                       *
```

```
## 22  ( 1 )                  *                  *              *
## 23  ( 1 )                  *                  *              *
## 24  ( 1 )                  *                  *              *
## 25  ( 1 )                  *                  *              *
## 26  ( 1 )                  *                  *              *
## 27  ( 1 )                  *                  *              *
##           NumEarlyClass ClassesMissed CognitionZscore PoorSleepQuality
## 1  ( 1 )
## 2  ( 1 )                                         *
## 3  ( 1 )                                         *
## 4  ( 1 )                                         *
## 5  ( 1 )                                         *
## 6  ( 1 )                                         *
## 7  ( 1 )                                         *
## 8  ( 1 )                                         *
## 9  ( 1 )                        *                *
## 10  ( 1 )                       *                *
## 11  ( 1 )                       *                *
## 12  ( 1 )                       *                *
## 13  ( 1 )                       *                *
## 14  ( 1 )                       *                *                 *
## 15  ( 1 )                       *                *
## 16  ( 1 )                       *                *                 *
## 17  ( 1 )                       *                *                 *
## 18  ( 1 )                       *                *                 *
## 19  ( 1 )             *         *                *                 *
## 20  ( 1 )             *         *                *                 *
## 21  ( 1 )             *         *                *                 *
## 22  ( 1 )             *         *                *                 *
## 23  ( 1 )             *         *                *                 *
## 24  ( 1 )             *         *                *                 *
## 25  ( 1 )             *         *                *                 *
## 26  ( 1 )             *         *                *                 *
## 27  ( 1 )             *         *                *                 *
##           DepressionScore AnxietyScore StressScore DepressionStatusnormal
## 1  ( 1 )
## 2  ( 1 )
## 3  ( 1 )                                     *
## 4  ( 1 )                                     *
## 5  ( 1 )                                     *
## 6  ( 1 )                                     *
## 7  ( 1 )                                     *
## 8  ( 1 )                                     *
## 9  ( 1 )                                     *
## 10  ( 1 )                                    *
## 11  ( 1 )                                    *
## 12  ( 1 )                                    *
## 13  ( 1 )                                    *
## 14  ( 1 )                                    *
## 15  ( 1 )                                    *
```

```
## 16  ( 1 )                                        *
## 17  ( 1 )                                        *                        *
## 18  ( 1 )               *            *
## 19  ( 1 )               *                         *
## 20  ( 1 )               *                         *
## 21  ( 1 )               *                         *
## 22  ( 1 )               *                         *
## 23  ( 1 )                            *            *
## 24  ( 1 )               *                         *
## 25  ( 1 )               *                         *
## 26  ( 1 )                            *            *
## 27  ( 1 )                            *            *                        *
##           DepressionStatussevere AnxietyStatusnormal AnxietyStatussevere
## 1  ( 1 )
## 2  ( 1 )
## 3  ( 1 )
## 4  ( 1 )
## 5  ( 1 )
## 6  ( 1 )
## 7  ( 1 )
## 8  ( 1 )
## 9  ( 1 )
## 10  ( 1 )
## 11  ( 1 )
## 12  ( 1 )
## 13  ( 1 )
## 14  ( 1 )
## 15  ( 1 )
## 16  ( 1 )
## 17  ( 1 )
## 18  ( 1 )                                                                 *
## 19  ( 1 )                                                                 *
## 20  ( 1 )                                                                 *
## 21  ( 1 )                                                                 *
## 22  ( 1 )                                                                 *
## 23  ( 1 )                                                                 *
## 24  ( 1 )                                                                 *
## 25  ( 1 )                                                                 *
## 26  ( 1 )                      *                                          *
## 27  ( 1 )                      *                                          *
##           Stressnormal DASScore Happiness AlcoholUseHeavy AlcoholUseLight
## 1  ( 1 )
## 2  ( 1 )
## 3  ( 1 )
## 4  ( 1 )                     *
## 5  ( 1 )
## 6  ( 1 )                     *
## 7  ( 1 )                     *
## 8  ( 1 )                     *
## 9  ( 1 )                     *
```

```
## 10  ( 1 )                     *                                                
## 11  ( 1 )                     *                                                
## 12  ( 1 )                     *                                                
## 13  ( 1 )                     *                         *                      
## 14  ( 1 )                     *                         *                      
## 15  ( 1 )                     *                         *                      
## 16  ( 1 )                     *                         *                      
## 17  ( 1 )                     *                         *                      
## 18  ( 1 )                     *                         *                      
## 19  ( 1 )                     *                         *                      
## 20  ( 1 )                     *                         *                      
## 21  ( 1 )                     *                         *                      
## 22  ( 1 )                     *                         *                *     
## 23  ( 1 )                     *                         *                *     
## 24  ( 1 )           *         *                         *                *     
## 25  ( 1 )           *         *         *               *                *     
## 26  ( 1 )           *         *         *               *                *     
## 27  ( 1 )           *         *         *               *                *     
##           AlcoholUseModerate Drinks WeekdayBed WeekdayRise WeekdaySleep       
## 1  ( 1 )                      *                                               
## 2  ( 1 )                      *                                               
## 3  ( 1 )                      *                                               
## 4  ( 1 )                      *                                               
## 5  ( 1 )                                                                      
## 6  ( 1 )                                                                      
## 7  ( 1 )                      *                                               
## 8  ( 1 )                      *                                               
## 9  ( 1 )                      *                                               
## 10  ( 1 )                     *                                        *      
## 11  ( 1 )                     *                                               
## 12  ( 1 )                     *                                        *      
## 13  ( 1 )                     *                                        *      
## 14  ( 1 )                     *                                        *      
## 15  ( 1 )                     *                                        *      
## 16  ( 1 )                     *                                        *      
## 17  ( 1 )                     *                                               
## 18  ( 1 )                     *                                        *      
## 19  ( 1 )                     *                                        *      
## 20  ( 1 )                     *                                        *      
## 21  ( 1 )                *    *                                        *      
## 22  ( 1 )                *    *                                        *      
## 23  ( 1 )                *    *                         *              *      
## 24  ( 1 )                *    *                         *              *      
## 25  ( 1 )                *    *                         *              *      
## 26  ( 1 )                *    *                         *              *      
## 27  ( 1 )                *    *                         *              *      
##           WeekendBed WeekendRise WeekendSleep AverageSleep AllNighter       
Rsq
## 1  ( 1 )                                                                     
7.25
```

```
## 2  ( 1 )
12.43
## 3  ( 1 )
16.16
## 4  ( 1 )
19.71
## 5  ( 1 )
22.22
## 6  ( 1 )
27.01
## 7  ( 1 )
29.49
## 8  ( 1 )
30.20
## 9  ( 1 )
30.76
## 10  ( 1 )
31.18
## 11  ( 1 )                                    *          *
31.57
## 12  ( 1 )                  *                            *
31.83
## 13  ( 1 )                  *                            *
32.07
## 14  ( 1 )                  *                            *
32.25
## 15  ( 1 )         *        *                 *          *
32.44
## 16  ( 1 )         *        *                 *          *
32.64
## 17  ( 1 )         *        *           *     *          *
32.80
## 18  ( 1 )         *        *                 *          *
32.95
## 19  ( 1 )         *        *                            *
33.12
## 20  ( 1 )         *        *                 *          *
33.30
## 21  ( 1 )         *        *                 *          *
33.43
## 22  ( 1 )         *        *                 *          *
33.50
## 23  ( 1 )         *        *                 *          *
33.55
## 24  ( 1 )         *        *                 *          *
33.59
## 25  ( 1 )         *        *                 *          *
33.62
## 26  ( 1 )         *        *                 *          *
33.64
```

```
## 27  ( 1 )          *           *                           *           *
33.65
##           adjRsq    Cp
## 1  ( 1 )    6.88 57.19
## 2  ( 1 )   11.73 42.08
## 3  ( 1 )   15.15 31.79
## 4  ( 1 )   18.41 22.08
## 5  ( 1 )   20.64 15.79
## 6  ( 1 )   25.23  1.97
## 7  ( 1 )   27.47 -4.22
## 8  ( 1 )   27.91 -4.58
## 9  ( 1 )   28.20 -4.43
## 10  ( 1 )  28.34 -3.80
## 11  ( 1 )  28.45 -3.10
## 12  ( 1 )  28.42 -1.96
## 13  ( 1 )  28.38 -0.75
## 14  ( 1 )  28.27  0.65
## 15  ( 1 )  28.16  2.05
## 16  ( 1 )  28.07  3.39
## 17  ( 1 )  27.93  4.87
## 18  ( 1 )  27.79  6.35
## 19  ( 1 )  27.66  7.80
## 20  ( 1 )  27.55  9.19
## 21  ( 1 )  27.38 10.78
## 22  ( 1 )  27.14 12.54
## 23  ( 1 )  26.88 14.37
## 24  ( 1 )  26.60 16.25
## 25  ( 1 )  26.30 18.16
## 26  ( 1 )  26.00 20.08
## 27  ( 1 )  25.69 22.04
```

Predictors: factor(ClassYear), ClassesMissed, CognitionZscore, PoorSleepQuality, StressScore, DASScore, Drinks, WeekdaySleep, WeekendRise, AllNighter.