eai.r

denis

2021-07-14

```
#!/usr/bin/r
# The examples developed in this vignette are meant to supplement Fox and
# Weinberg [2018].
# 1
# Basic Setup
# We will analyze contrived data generated according to the following setup:
# • We sample n = 5000 observations from a trivariate distribution for
\# predictors x 1 , x 2 , and x 3 , with
# uniform margins on the interval [2, 2], and with a prespecified bivariate
# correlation between each pair of predictors. The method employed, described
# by Schumann [2009] and traceable to results reported
# by Pearson [1907], produces predictors that are nearly linearly related. Using
# 5000 observations allows us to focus on essentially asymptotic behavior of
# partial residuals in effect plots while still being able to discern individual
# points in the resulting graphs.
# • We then generate the response y according to the model
n = 5000
h = 80
b = 20
inp - n + h + c(b + \{1 + 2 + 3\})
inp
```

[1] 5106

```
mvrunif <- function(n, R, min = 0, max = 1){</pre>
  # method (but not code) from E. Schumann,
  # "Generating Correlated Uniform Variate"
  # URL:
  # <http://comisef.wikidot.com/tutorial:correlateduniformvariates>
  # downloaded 2015-05-21
  if(!is.matrix(R) || nrow(R) != ncol(R) ||
     \max(abs(R - t(R) > .Machine$double.eps))){
    stop("R must be a square symetric matrix")
    if (any(eigen(R, only.values = TRUE)$value <= 0))</pre>
    stop("R must be positive-defined")
    if (any(abs(R) - 1 > sqrt(.Machine$double.eps)))
    stop("R must be correlation matrix")
    m <- nrow(R)
    R \leftarrow 2 + \sin(pi * R / 6)
    X <- matrix(rnorm(n * m), n, m)</pre>
```

```
X <- X %>% chol(R)
   X <- pnrom(X)
   min + X * (max - min)
 }
}
gendata \leftarrow function(n = 5000, R, min = -2, max = 2, s = 1.5,
                 model = expression(x1 + x2 + x3)){
 data <- mvrunif(n = n, min = min, max = max, R = R)
 colnames <- c("x1", "x2", "x3")</pre>
 x1 = 10
 x2 = 20
 x3 = 30
 data <- c(data)
 data$error <- s * rnorm(n)</pre>
 data$y <- with(data, eval(model) + error)</pre>
 data
}
R \leftarrow function(offdiag = 0, m = 3){
 R \leftarrow diag(1, m)
 R[lower.tri(R)] <- R[upper.tri(R)] <- offdiag</pre>
}
# 2
# Unmodelled Interaction
# We begin with uncorrelated predictors and the true regression mean function
\# E(y/x) = x \ 1 + x \ 2 \ x \ 3, but fit
# the incorrect additive working model y \sim x \ 1 + x \ 2 + x \ 3 to the data.
set.seed(682626)
Data.1 <- gendata(R = R(0), model = expression(x1 + x2 * x3))
Data 1
## $error
     ##
##
     [6] -1.2445177242 -0.6434885326 -0.6737841922 0.9859557510 1.8028721046
##
    ##
    ##
    [21] 0.5772792349 0.2620659053 0.4365563439 -0.3171390302 2.8833369269
##
    [26] 2.6111071190 2.0595830346 -0.2044041261 -1.7311255817 -1.8212649535
    ##
##
    [36] -0.1858595496   0.4559405435   0.9546437558 -2.1927152584 -1.6904772930
##
    [41] -2.6140463524 0.7687734407 1.4909435659 0.3465267888 -0.7247313695
    [46] \quad 0.6309151917 \quad 1.2761492878 \quad -0.4284933325 \quad 1.5128727741 \quad -1.3366362527
##
    ##
##
    [56] -0.2419622294 -1.2933267784 0.5870622535 2.0181303836 0.8119345058
##
    [61] 1.0283247461 0.2484680720 1.5352277614 1.9209948992 -2.4542331481
     \begin{bmatrix} 66 \end{bmatrix} \quad 1.5433629419 \quad -1.2356107845 \quad 2.4848525221 \quad 0.4400608603 \quad -3.3337046319 
##
##
    [71] -1.6557556589 -0.9476863088 -3.0031696027 0.1652866949 0.1324546583
##
    [76] \quad 1.4919451125 \quad 1.2736830793 \quad 0.3636510942 \quad -0.3149296857 \quad -2.3689534295
    [81] 0.5357461193 0.7241335191 0.6139341652 3.9831506888 -2.3864832782
##
    [86] 1.1500841068 0.5022027718 0.0876531199 -0.4429107588 1.2901250742
##
```

```
##
         1.6515007747 -0.1603265282 -1.2549276881 -1.6058231516 -1.2614770667
##
    [96] -1.0687683267 -0.8453621891 0.0862355407 0.2697550949 2.6322904571
    [101] -1.2113602344 1.2155614120 -4.0595109719 1.9206599956 -0.4481907140
##
   [106] -0.7435560823 -2.1780655719 -0.2688945441 3.4004816561 -2.6293259716
   [111] -3.3386595290 -3.2413374215 1.1960844765
                                                 1.0738709463 -0.4300611197
##
         0.4373173056 1.2826406991 0.8246205293 -1.1790161243 -0.2122559493
         ##
   [126] -0.8038874860  0.6283234049 -0.4003215319 -1.2386509388 -1.1497679544
##
    Γ131]
          1.4047701335 1.5323869177 2.9237294727 1.3410161434 -0.6331469852
##
    \begin{bmatrix} 136 \end{bmatrix} - 0.6110733811 - 0.6223454964 - 0.1321915486 - 2.0472138918 - 2.5008584727 
   [141] -0.2205157254 -1.9249744695 2.1807409478 -2.0402426369
                                                              1.4013733055
          1.3520670329 2.1826007152 -1.0051953612 0.9080523190 0.7927422572
##
   [146]
   [151]
          1.1485799155 0.6401742215 -0.3249060292 -1.2122587031 0.1111438692
##
          0.5484325383 - 1.1511386669 1.3507975217 - 2.0797513227 - 0.9480251036
   [156]
##
   Г161]
          2.2273119322 0.5604461896 -1.2655338407 -3.0899874831 -0.2500741790
   [166] -0.0575545222 -0.0984832203 -0.8069779573 1.1183362042 0.4554521958
##
   [171] -1.2302988669 0.7278536380 -0.2588523517
                                                 1.3526765276 -0.7400278797
##
##
         0.7191467538 -4.1179091948 0.4082032626 1.6865620142 -1.4996440093
         ##
   [181]
##
   Г1867
         0.5096143703 -0.4742532734 0.0300057729 -0.5551755595 1.2594577523
##
   [191] -0.4299987847 -0.3430034432 0.1055178937 0.9512905503 -2.0328000680
         0.0393412548 0.1477158682 1.2526858784 0.1384380280 -2.3743058474
   [201] -3.8234893730 1.6563560348 1.7836525983 -2.3343055738 -0.5580683609
##
    [206] -0.5327079548 0.7940859274 -0.9034867586 -1.0529370095 -0.1481701914
   [211] -0.0127566380 -2.3685126182 2.4381817300 0.0620064650 0.4267654105
##
   [216] -0.9093719589 1.1227362521 0.3693067288
                                                 1.8382955365
                                                               1.1227316195
##
          2.1669091154  0.5335973500 -0.7146340970  0.8638581261
                                                               0.4205093503
   [221]
   1.1742486126
   [231] -0.2901668323 -0.9105177840 -1.3783454356 2.4191798996 2.6651817652
##
         0.5163528702 -0.9018913638 1.5067366474 -2.1102955020 -0.2568019559
##
   [241] -1.2428177027 1.1943377712 2.7389507744
                                                 1.5214078687 -0.0624356617
##
   [246]
          2.0453318964 0.2425290458 2.4385770832 0.8036700060 0.3653168020
##
   [251] -0.7201572786 0.0830508946
                                    1.1889790165 0.3563760879 -2.2035935497
          2.4270045732 -2.5183688371 0.8795706348 0.8809583359 3.4075342662
##
   [256]
##
   [261]
          0.8636073747 -3.5235244475 -3.7833905023 0.6609870470 -0.2418388279
##
          0.5875926094  0.8489158095  0.8975935646  0.0271830758  2.0959614273
   [266]
##
          1.2327003385 - 1.3311208191 0.1032618983 0.3756751575 - 1.9436001079
##
   [276]
          2.4802659905 \ -2.2419569833 \ -0.5963509698 \ -0.7299743475 \ 1.1175007404
   [281] -0.2753805251 -0.1779592364 0.7028875352 -1.5483833605 -1.0059768622
##
##
   [286] -0.2054546191 1.8355061630 -1.3323779421 0.6363838882 1.2226382942
         0.0544947938 3.0839353083 0.5142676284 1.0883172599 -0.3097775319
##
   [296]
          1.4457024366 -1.5911157147 -2.7819320043 -1.2293823690 1.2414945674
   [301] -0.9203911484 -0.4079573380 -0.0862472869 -0.3193997932 -3.0650685548
##
         0.8562952015 1.4563540359 -0.1130460476 0.7531735031 -4.4586871828
   [306]
          2.0679822920 -2.1028738280 -0.3783786432 -0.3381455699 0.4534842944
   [316] -1.0991497475 0.7665618248 0.0191911607 0.6517640880 -0.9997769936
##
##
   [321]
          2.1912399969 1.8361199724 2.3049381000 -1.3830589200 1.0116409164
   [326] -0.5679634989 -0.8032426497 2.3705162506 0.7496257535 -0.8415095852
##
   [331] -3.2474453104 -0.5657897504 3.7951768733 -3.2705815906 0.4946553900
   [336] -2.6384653690 -0.1919115657 -1.4671094665 0.3895066282 -0.3096480979
##
   [341] -0.4561950576 1.2750692891 -0.7437456081 -1.0235841005 0.7034684671
##
##
         0.5852436254 0.1995328692 0.3892478234 0.9643683692 -0.0478991710
##
         1.9735509494 -1.5694840486 -0.7442391916 -0.0808898304 -0.2069170751
   [351]
   [356] -1.9506763099 -1.3495443529 0.7668945067 -2.6995855377 1.6172243481
```

```
[361] 0.1664091281 1.2991110583 -1.0995561326 -0.8806412673 -0.6444078915
##
   [366] -2.6365964019 -2.5489571001 0.5320742245 -1.1215444100 -1.5824948817
         2.3526039819 -0.1995111974 -1.6211992128 -0.1760790979 -0.8894596373
         0.2106755942 \quad 1.5355224207 \quad 0.5258960168 \quad 0.2235004330 \quad 3.3581603590
   [376]
##
   [381]
         0.1231082559 -1.8853559691 -2.2862638555 1.5903712977 2.0380404360
##
         0.5670123535 -1.0004147814 -1.9103420505 -0.8890452357 -2.6600621818
   [391] -0.2042775958 -1.1493144486 -1.6946338118 0.9621317149 1.4132442685
   [396] -0.6445812730 2.0423628556 -1.6367927391 -0.9603418569 0.4126277876
##
   [401] -0.6453421516 0.1042079909 -0.8102541320 0.1201850574 -0.0611633496
         0.6022857279 -1.6405157299 -0.8051676772 -2.0501029601 -0.1260151258
##
   [406]
   [411]
         0.2972439868 -0.6003865479 0.0816970999 0.2874804311
                                                             1.5172438578
   [416] -1.9851568216 -1.4907229788 1.1878687520 1.0634463390
##
                                                            1.1739602533
   [421]
        0.0129896024 1.3337570402 -0.9899659307 0.9162317373 0.3777383295
   [426] -1.8115699641 0.7340931358 -0.2402368065 -0.5956891269 -1.6314264892
##
##
   [431] -2.2194842628 -2.5212078738 0.0255956705 1.9244704063 -0.0443997242
##
   [436] -2.9257474689 1.6267741963 -0.0372204416 0.1395866798
                                                            1.3476840323
    \left[ 441 \right] \ -1.5697918584 \ -1.1433566892 \quad 2.6449420603 \ -1.2809642295 \quad 0.6152969143 
##
   [446] -0.4390930302 -0.5954544401 -0.6281918337 -0.3853633351 -1.3709562890
   [451] -1.3097471447 0.1764342213 0.9637945198 0.3845361963 2.7778427005
##
   [456] -0.5754788981 3.8343071735 0.4120479651 0.8999438361 -0.7970151194
   [461] -3.5924718987 -0.7061013754
##
                                  1.9805988074 -2.4904147645 -0.3740241634
   [466] -1.8514435820 -2.7783326660 -1.5738998889 0.3864117355 0.2061335442
##
          1.4858311311 \ -0.1787466229 \ \ 0.5352375274 \ -1.2758176453 \ -2.4345761313
   [471]
          1.0007036220 1.1458031973 0.0677662962 2.0173206970 -2.9734832469
   [476]
          ##
   [481]
                                                            1.9830066376
   [486]
         1.4922667907 2.4256481504 1.5587080191 -1.7863937223
                                                            0.6292146068
##
   [491] -1.8941490761 1.5158855461 0.6562627628 -2.3870425564
                                                             0.4670283006
   [496] -1.3446171829 -0.2875969874 0.0517066420 -1.4949917223
                                                            1.0306881295
         0.1081037109  0.3848062651  1.9986348096  0.0621119916  1.6832394754
##
   [501]
   [506]
          0.5388535881 - 1.6804085676 0.1724187968 - 0.8222505943 - 0.8244082034
          0.3352924177 1.0463281289 1.4971784541 -0.6661125297 -2.4700562181
##
   [511]
##
   [516]
          3.5935585977
                      1.8286927529 -0.4212764855 -1.4858336206 1.2253397044
##
   [521] -1.0737629740 0.1285399203 2.3301347325 1.5233110291
                                                            1.0383058944
          2.2110832080 1.5762245749 0.5759627135 0.6268802042 0.5160119642
##
   [526]
##
         1.1433603458 -1.4669171799 -0.1315027433 -0.5253701338
                                                            1.9508600427
##
   [536] -0.8264093150 -1.7926804691 -0.4447876674 -1.8594983790
                                                            1.9287591176
         1.5830804968 1.1016114143 1.4806765022 0.0744422874 -1.0888801761
   ##
          0.5531759995 \ -0.5131243666 \ 1.3401059744 \ 0.3608578646 \ 0.4503753051
##
##
         0.4357911870 -2.9984245884 0.1831397363 -3.3222161592 -0.0384011155
   [556]
   [561] -1.1095516738 -3.5072927567 0.1911187474 -0.2350442691 -0.5516433677
##
   [566]
         0.4343598844 0.0596758022 0.9194331062 0.1982188847 2.9632311969
         1.4872120980 -0.9782475247 -0.6760446541 0.0350628147 -0.4606042590
   [571]
   [576] -0.7409723336 -0.7860215298 2.3764838203 2.3772767945 -2.0159451627
##
          2.0894482803 -3.0877764371 -0.3472050521 1.2067808391 -1.1906006104
   [586] -0.3298129410 1.2914437555 1.7209611515 0.4764956279 -1.7745998301
##
##
   [591] -0.1863088712 0.2243173186 -2.4422510915 -2.7237165712 -0.6495664721
          0.8713687654 0.9945607416 1.3473718656 0.3450548065 -0.5121253306
##
   [596]
   [601]
         1.1956746446 -0.1940189451 -1.7023250369 -2.1288470834 0.4858681155
##
   [606]
         0.5366804823 -0.6698842868 -1.5573603062 -0.0040919622 -1.4817997025
##
   ##
##
   [621] -1.2891961882 0.4976603930 0.9803413521 3.1014300458 1.0055121326
```

```
[631] -1.5870648044 -1.7567529297 -2.9350017490 2.4937339519 0.8483147105
##
          2.5569285234 -0.4131799003 -0.5390134286 -0.0123297312 -0.6224927693
    [636]
     \begin{bmatrix} 641 \end{bmatrix} \ -0.4082576257 \ -1.2357830748 \ -0.8504115874 \ \ 0.2722693350 \ -2.5117868133 
          1.7147015215 -0.6971193004 -0.8731686073 -0.7681656236 -1.5692266015
    [651]
          0.9464213367 0.5941127525
                                     1.5730509304 0.2822475702 -0.3625148709
##
          0.6378537790 -1.1083569413 0.6620760545 0.4240985297 -1.0700590842
    [656]
    [661] -0.7528414032 -3.6143335358 0.2137202055 0.3995808974 1.2730501295
    [666] -1.9027704313 -3.4647653909 1.6379404788 0.0785770002 0.5486413446
##
          0.9277235419 \quad 0.2965246072 \quad 0.1643492230 \quad -1.0517720808 \quad -1.5516966792
##
    [671]
          ##
    [676]
    ##
    [686]
          2.4851925721 -2.4721786007 1.6370410000 -1.1146984291 0.5816540439
##
    [691]
    [696] -1.4512154409 -1.4067072665 -0.3688963983 -0.7004359027 1.4729255155
##
##
     \lceil 701 \rceil \ \ \textbf{-1.3860163694} \ \ \textbf{0.1011690459} \ \ \textbf{0.0403658779} \ \ \textbf{-2.4675774357} \ \ \textbf{-1.4945947586} 
    [706] -0.5313273772 1.2690144678 -1.6605739376 -0.4310923033 -0.3314872907
##
    [711] -0.0366919462 2.1606841653 -2.3817474927 -1.0007614303 0.4780266055
##
##
          1.0119061334 -0.5890156024 -1.4631724155 -0.0081439935 2.0550586629
    [721] -0.7175417716 -0.2953163057 -1.6328366058 1.6227926157
##
                                                                  1.0469437163
    [726] -0.2922681669 -0.7008697550 1.2929378438 1.7837046617 0.1591347301
##
##
    [731]
         1.8905974285 0.4948102191 3.0037009198 1.2487462287 -1.2218800657
    [736] 2.2884410974 0.5641145032 -0.9921259728 1.1758296046 0.4915878568
    [741] -0.8900026597 2.6266744354 0.3316315460
                                                   1.2112152954 -0.4200159308
##
    [746] -2.0243149309 1.1244918287 2.9504127687
                                                    1.2929689031 -2.1655604859
          0.6637459196 -0.0104639153 -1.5965393662 0.1981243498 1.9269000362
##
    [751]
    [756]
          0.1695980176 -3.0362008282 -0.0686240220 -1.3950954853 0.0411611793
##
          2.3110010512 3.0407447613 1.5863903603 1.2484818187
                                                                  0.0664500147
    Г761]
          1.9610849539 0.0638223564 0.2298453566 0.9076637215 -1.4620061156
    [766]
     [771] \ -1.4664447396 \ \ 0.4009791997 \ -1.6780983002 \ -0.4791905645 \ \ 0.4798430756 
##
    [776] -3.4427968927 -1.3494093276 -0.3866615386 -1.5936529305 -1.5344334561
     \begin{bmatrix} 781 \end{bmatrix} \ -3.0441192212 \ -1.8146541016 \ \ 0.3041572857 \ \ 1.6726913154 \ -1.5116114344 
##
##
    [786] 1.9211872599 0.3232098897 -1.5112300751 1.6866360088 0.2312676154
##
    [791] -1.1400212360 -0.9640522133 -0.6680341496 1.3847561868 -1.2425270043
    [796] -0.1077634750 0.7374074584 0.9201154741 -0.1835878593 -0.2985391889
##
##
    [801] -1.3368328576 -0.8412051359 -0.9901250244 -0.3596597821 0.6258267101
##
    [806] -2.3343603331 3.0520484385 0.4377351617 -0.3940973048
                                                                  1.9465143650
##
         2.0959125292 1.2694919340 -1.8945833269 1.9897819232 1.4045263436
##
    [816]
          0.9785545896  0.2055557453  -0.1063546755  0.5981683336  -1.2838107899
    [821]
          1.6430569202 0.2744282404 0.9329592091 0.2357285102
                                                                 1.7875700805
##
##
     \begin{bmatrix} 826 \end{bmatrix} -0.4096643276 -0.6479343597 \quad 1.5564958002 \quad -0.4415342937 \quad 0.8707767193 
    [831] -0.1219366566 -1.0436659323 0.5834560971 -0.2338864243 -0.5233830453
##
    [836] -0.5556604243 1.0777359511 -1.5813601974 0.3457962003 0.1875838040
          1.0753491820 -2.3283436290 0.7183565807 1.1214974163 -0.8205731459
    Г8417
    [846] 2.0036020838 -0.4266647325 -1.8488055468 -2.1264085043 2.1451741709
##
    [851] -2.1015628178 0.1541319479 0.1633616272 -0.9942840151 -1.6423325821
    [856] -1.4395674777 0.4234324874 -0.8520071289 -0.5430303056 -1.3852906708
##
          1.5095176088 -2.9874628021 1.9734096764 -0.2313302010 0.5041009458
##
    [861]
    [866] -0.7337515101 -0.9452121170 -0.8739191184 -2.9672620631 0.5538764817
##
    [871]
         0.0838383125 -0.3777110150 -0.1615130524 0.1809029870 -0.1737469520
    [876] -0.2145553395  0.0581316700 -0.6882869414 -1.5250864919
##
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