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1   ###SEM lavaan関数
2   library(MASS)
3   data("Cars93")
4   str(Cars93)
5   colnames(Cars93)
6   ####欠測値処理
7   anyNA(Cars93[,c(1:27)]) #指定範囲の項目にNAがあるか
8   cars93 <- na.omit(Cars93) #NAをすべてomitしたファイル作成
9
10  install.packages("lavaan")
11  library(lavaan)
12  # =~:潜在変数(測定方程式), ~:回帰(構造方程式), ~=:分散,共分散, ~1:切片
13  ##重回帰モデル
14  model.R <- '
15  #回帰
16  MPG.city ~ Rev.per.mile
17  MPG.city ~ Fuel.tank.capacity
18  MPG.city ~ Weight
19  MPG.city ~ Wheelbase
20  '
21  result.R <- sem(model = model.R, data = cars93,
22                estimator = "ML", sample.nobs = 82)
23  fitMeasures(result.R, c("gfi","agfi","srmr","rmsea","aic","bic"))
24  parameterEstimates(result.R) ##非標準化推定値
25  standardizedSolution(result.R) ##標準化推定値
26  residuals(result.R, type = "cor")
27  modificationIndices(result.R, sort = T, minimum.value = 5)
28
29  library(semPlot) ###標準化推定値
30  semPaths(object = result.R, optimizeLatRes = T, whatLabels = "stand",
31          layout = "tree2", rotation = 2, edge.label.cex = 0.8,
32          sizeMan = 8, sizeLat = 10, style = "lisrel", ##ram,mx,OpenMx,
33          residScale = 15, curve = 2.6,
34          manifests=c("MPG.city","Rev.per.mile","Fuel.tank.capacity",
35                    "Weight","Wheelbase"),
36          nodeLabels=c("燃費","回転数","タンク量","車重","軸長"))
37  ##style =ram,mx,OpenMx,
38  library(semPlot) ###非標準化推定値
39  semPaths(object=result.R,optimizeLatRes=T,whatLabels="est",
40          layout="tree2",rotation=2,edge.label.cex=0.8,
41          sizeMan = 8, sizeLat = 10, style = "lisrel",
42          residScale=15,curve=2.6,
43          manifests=c("MPG.city","Rev.per.mile","Fuel.tank.capacity",
44                    "Weight","Wheelbase"),
45          nodeLabels=c("燃費","回転数","タンク量","車重","軸長"))
46
47  ###検証的因子分析
48  #bfi
49  dataを利用す.data内容は(https://www.personality-project.org/r/html/bfi.html)
50  ##項目名:A1-A5 (Agreeableness), C1-C5 (Conscientiousness), E1-E5 (Extraversion),
51  ##N1-N5 (Neuroticism), O1-O5 (Openness), 性,教育歴,年齢
52  ###Agreeableness:協調性
53  #A1:Am indifferent to the feelings of others.
54  #A2:Inquire about others' well-being.
55  #A3 Know how to comfort others.
56  #A4:Love children.
57  #A5:Make people feel at ease.
58  ###Conscientiousness:勤勉性
59  #C1:Am exacting in my work.
60  #C2:Continue until everything is perfect.
61  #C3:Do things according to a plan.

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61 #C4:Do things in a half-way manner.
62 #C5:Waste my time.
63 ###Extraversion:外向性
64 #E1:Don't talk a lot.
65 #E2:Find it difficult to approach others.
66 #E3:Know how to captivate people.
67 #E4:Make friends easily.
68 #E5:Take charge.
69 ###Neuroticism:情緒不安定性
70 #N1:Get angry easily.
71 #N2:Get irritated easily.
72 #N3:Have frequent mood swings.
73 #N4:Often feel blue.
74 #N5:Panic easily.
75 ###Openness:開放性
76 #O1:Am full of ideas.
77 #O2:Avoid difficult reading material.
78 #O3:Carry the conversation to a higher level.
79 #O4:Spend time reflecting on things.
80 #O5:Will not probe deeply into a subject.
81 #gender:Males = 1, Females =2
82 #education:1=HS高校入学,2=finished HS高卒,3=some college 大学入学,
83 # 4=college graduate 大卒,5=graduate degree 院卒
84 #age:age in years
85
86 library(psych)
87 data(bfi)
88 str(bfi)
89 colnames(bfi)
90 dat <- bfi #bfiをdatに代入
91 #反転項目(6項目)を反転:1-6を6-1に
92 dat.R <- data.frame(dat ,
93                     7-dat$A1,
94                     7-dat$C4,7-dat$C5,
95                     7-dat$E1,7-dat$E2,
96                     7-dat$O2,7-dat$O5)
97 colnames(dat.R)
98 names(dat.R)[29:35] <- c("R.A1", #リネーム
99                        "R.C4", "R.C5",
100                       "R.E1", "R.E2",
101                       "R.O2", "R.O5")
102 colnames(dat.R)
103 ###欠測値処理
104 anyNA(dat.R[,c(1:25)]) #NAがあるか
105 dat.omit <- na.omit(dat.R[,c(1:25,29:35)]) #NAをomitしたファイル
106 nrow(na.omit(dat.omit)) #リストワイズ後サンプル数
107 colnames(dat.omit)
108 describe(dat.omit[,c(2:8,13:21,23,24,26:32)]) #statistic
109 b.cor <- round(cor(dat.omit[,c(2:8,13:21,23,24,26:32)]),3)
110 round((b.cor),2)
111 cor.plot(cor(dat.omit[,c(2:8,13:21,23,24,26:32)]))
112
113 #Modelは5因子
114 #グラフ出力の見やすさを考慮し3因子で出力
115 library(lavaan)
116 # =~:潜在変数(測定方程式), ~:回帰(構造方程式), ~~:分散,共分散, ~1:切片
117 model <- '
118 #F1 =~ N1 + N2 + N3 + N4 + N5
119 F2 =~ R.E1 + R.E2 + E3 + E4 + E5
120 F3 =~ R.C4 + R.C5 + C1 + C2 + C3
121 F4 =~ R.A1 + A2 + A3 + A4 + A5

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122 #F5 =~ R.O2 + R.O5 + O1 + O3 + O4
123 #F1 ~~ F2
124 #F1 ~~ F3
125 #F1 ~~ F4
126 #F1 ~~ F5
127 F2 ~~ F3
128 F2 ~~ F4
129 #F2 ~~ F5
130 F3 ~~ F4
131 #F3 ~~ F5
132 #F4 ~~ F5
133
134 '
135 result2 <- cfa(model = model , data = dat.omit ,
136               estimator = "ML", sample.nobs = 2436)
137 fitMeasures(result2 , c("gfi","agfi","srmr","rmsea","aic","bic"))
138 parameterEstimates(result2) ##非標準化推定値
139 standardizedSolution(result2)##標準化推定値
140 modificationIndices(result2 , sort = T , minimum.value = 5)
141 residuals(result2 , type = "cor")
142 predict(result2)
143 f_score2 <- predict(object = result2)
144 plot(f_score2)
145
146 library(semPlot) ###標準化推定値
147 semPaths(result2,"std")
148 semPaths(object = result2, optimizeLatRes = T ,
149          whatLabels = "stand", layout = "circle", rotation = 3,
150          edge.label.cex = 0.8, sizeMan = 9 , sizeLat = 6 ,
151          style = "lisrel" , residScale = 15 , curve = 1.3,
152          reorder=F ,
153          # manifests=c() ,
154          # nodeLabels=c()
155
156          )
157 ##style =ram,mx,OpenMx,lisrel,lauout=tree2,spring,circle
158
159 ###非標準化推定値
160 library(semPlot)
161 semPaths(object=result2,optimizeLatRes=T,
162          whatLabels="est", layout="tree2",rotation=1,
163          edge.label.cex=0.8, sizeMan = 7 , sizeLat = 11 ,
164          style = "lisrel" , residScale=15,curve=1.6,reorder=F,
165          # manifests=c() ,
166          # nodeLabels=c()
167          )
168
169 ##多重指標モデル:外向性と勤勉性の協調性への影響程度をみる
170 library(lavaan)
171 # =~:潜在変数(測定方程式), ~:回帰(構造方程式), ~~:分散,共分散, ~1:切片
172 model.m <- '
173 F2 =~ R.E1 + R.E2 + E3 + E4 + E5
174 F3 =~ R.C4 + R.C5 + C1 + C2 + C3
175 F4 =~ R.A1 + A2 + A3 + A4 + A5
176 F4 ~F2 + F3
177 F2 ~~ F3
178
179 '
180 result3 <- sem(model = model.m , data = dat.omit ,
181               estimator = "ML", sample.nobs = 2436)
182 fitMeasures(result3 , c("gfi","agfi","srmr","rmsea","aic","bic"))

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183 parameterEstimates(result3) ##非標準化推定値
184 standardizedSolution(result3)##標準化推定値
185 modificationIndices(result3 , sort = T , minimum.value = 5)
186 residuals(result3 , type = "cor")
187 predict(result3)
188
189 library(semPlot)
190 semPaths(result3,"est")    ###非標準化推定値
191 semPaths(object = result3, optimizeLatRes = T ,
192           whatLabels = "stand", layout = "tree2", rotation = 3, ###標準化推定値
193           edge.label.cex = 0.8, sizeMan = 9 , sizeLat = 6 ,
194           style = "lisrel" , residScale = 15 , curve = 1.3,
195           reorder=F ,
196           # manifests=c(),
197           # nodeLabels=c()
198           )
199
200
```