

11 ExpoPanel module

11.1 Application domain

ExpoPanel module is designed to conduct the analysis of the panel data. It mainly aims to evaluate the associations between exposure factors and the health outcome.

11.2 Theory

11.3 Work pipeline

Users can easily get the modeling results and their visualization plots with high quality by following the detailed instructions in each step. Linear mixed effect model is adopted to evaluate the association.

```
# The following two packages should be installed in advance
# devtools::install_github("ExposomeX/expanel", force = TRUE)
# devtools::install_github("ExposomeX/extidy", force = TRUE)

# library(expanel)
# library(extidy)
library(tidyverse)

# devtools::install_github("ExposomeX/exposomex", force = TRUE)
library(exposomex)
```

```
res = InitPanel()
res$PID
```

```
## [1] "145800XZKZHT"
```

```
res1 = LoadPanel(PID = res$PID,
                  UseExample = "example#1")
```

```
res1$Expo$Data
```

```
## # A tibble: 150 x 208
##   SampleID SubjectID Group   Y1   Y2   C1   C2   C3   X1   X2   X3
##   <chr>         <dbl> <chr> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl>
## 1 Tr1             1 train   1  106 0.0473 0.623 0.593 0.234 0     0
## 2 Tr2             1 train   0   56 0.0392 0.276 0.186 0.189 0     0
## 3 Tr3             1 train   0   42 0.0526 0.423 0.343 0.225 0     0
## 4 Tr4            16 train   1   66 0.0860 0.557 0.608 0.290 0     0
## 5 Tr5            16 train   0   33 0.109  0.405 0.385 0.322 0     0
## 6 Tr6            16 train   0   13 0.0886 0.433 0.458 0.307 0.0103 0.0310
## 7 Tr7            28 train   1   68 0.0826 0.509 0.536 0.291 0.0168 0.0880
## 8 Tr8            28 train   0   40 0.0979 0.382 0.392 0.328 0.00480 0.0588
## 9 Tr9            28 train   0   19 0.0904 0.346 0.338 0.305 0.00966 0.0878
## 10 Tr10           36 train   1  104 0.122  0.378 0.529 0.280 0.0840 0.212
## # ... with 140 more rows, and 197 more variables: X4 <dbl>, X5 <dbl>, X6 <dbl>,
## #   X7 <dbl>, X8 <dbl>, X9 <dbl>, X10 <dbl>, X11 <dbl>, X12 <dbl>, X13 <dbl>,
## #   X14 <dbl>, X15 <dbl>, X16 <dbl>, X17 <dbl>, X18 <dbl>, X19 <dbl>,
## #   X20 <dbl>, X21 <dbl>, X22 <dbl>, X23 <dbl>, X24 <dbl>, X25 <dbl>,
## #   X26 <dbl>, X27 <dbl>, X28 <dbl>, X29 <dbl>, X30 <dbl>, X31 <dbl>,
## #   X32 <dbl>, X33 <dbl>, X34 <dbl>, X35 <dbl>, X36 <dbl>, X37 <dbl>,
## #   X38 <dbl>, X39 <dbl>, X40 <dbl>, X41 <dbl>, X42 <dbl>, X43 <dbl>, ...
```

```

res2 = TransImput(PID=res$PID,
                  Group="T",
                  Vars="all.x",
                  Method="lod")

res3 = DelNearZeroVar(PID = res$PID)

res4 = DelMiss(PID = res$PID)

res5 = TransType(PID=res$PID,
                  Vars="Y1",
                  To="factor")

res6 = TransClass(PID=res$PID,
                  Group="F",
                  Vars="X1",
                  LevelTo="4")

res7 = TransScale(PID=res$PID,
                  Group="T",
                  Vars="all.x",
                  Method="normal")

res8 = TransDummy(PID=res$PID,
                  Vars="default")

res7$Expo$Data

## # A tibble: 150 x 208
##   SampleID SubjectID Group Y1      Y2      C1      C2      C3 X1      X2      X3
##   <chr>      <dbl> <chr> <fct> <dbl> <dbl> <dbl> <dbl> <fct> <dbl> <dbl>
## 1 Tr1          1 train 1      106 0.0473 0.623 0.593 1      -0.944 -1.14
## 2 Tr2          1 train 0       56 0.0392 0.276 0.186 1      -0.944 -1.14
## 3 Tr3          1 train 0       42 0.0526 0.423 0.343 1      -0.944 -1.14
## 4 Tr4         16 train 1       66 0.0860 0.557 0.608 2      -0.944 -1.14
## 5 Tr5         16 train 0       33 0.109   0.405 0.385 3      -0.944 -1.14
## 6 Tr6         16 train 0       13 0.0886 0.433 0.458 2      -0.673 -0.691
## 7 Tr7         28 train 1       68 0.0826 0.509 0.536 2      -0.501  0.124
## 8 Tr8         28 train 0       40 0.0979 0.382 0.392 3      -0.817 -0.294
## 9 Tr9         28 train 0       19 0.0904 0.346 0.338 2      -0.689  0.122
## 10 Tr10        36 train 1      104 0.122   0.378 0.529 2       1.27   1.91
## # ... with 140 more rows, and 197 more variables: X4 <dbl>, X5 <dbl>, X6 <dbl>,
## #   X7 <dbl>, X8 <dbl>, X9 <dbl>, X10 <dbl>, X11 <dbl>, X12 <dbl>, X13 <dbl>,
## #   X14 <dbl>, X15 <dbl>, X16 <dbl>, X17 <dbl>, X18 <dbl>, X19 <dbl>,
## #   X20 <dbl>, X21 <dbl>, X22 <dbl>, X23 <dbl>, X24 <dbl>, X25 <dbl>,
## #   X26 <dbl>, X27 <dbl>, X28 <dbl>, X29 <dbl>, X30 <dbl>, X31 <dbl>,
## #   X32 <dbl>, X33 <dbl>, X34 <dbl>, X35 <dbl>, X36 <dbl>, X37 <dbl>,
## #   X38 <dbl>, X39 <dbl>, X40 <dbl>, X41 <dbl>, X42 <dbl>, X43 <dbl>, ...

res7$Expo$Voca

## # A tibble: 205 x 5
##   SerialNo SerialNo_Raw FullName      GroupName Lod
##   <chr>      <chr>      <chr>      <chr>      <lg1>

```

```
## 1 Y1      Y1      TL_cat2      Outcome  NA
## 2 Y2      Y2      TL      Outcome  NA
## 3 C1      C1      cMCs_NFkB_unstim immunome NA
## 4 C2      C2      CCR2poscMCs_STAT3_unstim immunome NA
## 5 C3      C3      MDSCs_STAT3_unstim immunome NA
## 6 X1      X1      DCs_S6_unstim immunome NA
## 7 X2      X2      DCs_MAPKAPK2_unstim immunome NA
## 8 X3      X3      DCs_NFkB_unstim immunome NA
## 9 X4      X4      CCR2negncMCs_NFkB_unstim immunome NA
## 10 X5     X5      NK_STAT5_unstim immunome NA
## # ... with 195 more rows
```

```
res9 = FindCovaPanel(PID=res$PID,
  OutPath= "default",
  VarsY = "Y1",
  VarsC_Prior = "default",
  VarsC_Fixed ="C1",
  Method = "single.factor",
  Thr = 0.1)

res9_1 = PanelAsso(PID=res$PID,
  VarsY = "Y1",
  VarsX = "X1,X2,X3,X4,X5,X6,X7,X8,X9,X10,X11,X12",
  VarsN = "multiple.factor",
  VarsRandomIpt = "SubjectID",
  VarsRandomSlp = "none",
  IncCova = "F")

res9_2 = PanelAsso(PID=res$PID,
  OutPath= "default",
  VarsY = "Y2",
  VarsX = "X1,X2,X3,X4,X5,X6,X7,X8,X9,X10,X11,X12",
  VarsN = "multiple.factor",
  VarsRandomIpt = "SubjectID",
  VarsRandomSlp = "none",
  IncCova = "F")

res10 = VizPanelAsso(PID=res$PID,
  OutPath= "default",
  VarsY = "Y1",
  VarsN = "multiple.factor" ,
  EffectThr = 0.5,
  Layout = "forest",
  Brightness = "dark",
  Palette = "default1")

res11_1 = PanelAsso(PID=res$PID,
  OutPath= "default",
  VarsY = "Y1",
  VarsX = "X1,X2,X3,X4,X5,X6,X7,X8,X9,X10,X11,X12",
  VarsN = "single.factor" ,
  VarsRandomIpt = "SubjectID",
  VarsRandomSlp = "none",
  IncCova = "F")
```

```

res11_2 = PanelAsso(PID=res$PID,
                    OutPath= "default",
                    VarsY = "Y2",
                    VarsX = "X1,X2,X3,X4,X5,X6,X7,X8,X9,X10,X11,X12",
                    VarsN = "single.factor" ,
                    VarsRandomIpt = "SubjectID",
                    VarsRandomSlp = "none",
                    IncCova = "F")

res12 = VizPanelAsso(PID = res$PID,
                    OutPath= "default",
                    VarsY = "Y1",
                    VarsN = "single.factor",
                    EffectThr = 0.5,
                    Layout = "forest",
                    Brightness = "dark",
                    Palette = "default1")

FuncExit(PID = res$PID)

## [1] "Success to exit. Thanks for using ExposomeX platform!"

```