9 ExpoMixEffect module

9.1 Application domain

ExpoMixEffect module is designed to analyze mixture effect of the various exposure factors. It mainly aims to screen the representative features with high contribution to the health outcome, as well as their potential interaction effect.

9.2 Theory

9.3 Work pipeline

Users can easily get the modeling results and their visualization plots with high quality by following the detailed instructions in each step. Three frequently used mixture-effect models are provided including multiple linear regression with regulation algorithms (e.g., stepwise, LASSO and elastic network), weighted quantile sum regression and Bayesian kernel machine regression.

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

# library(exmix)
# library(extidy)
library(tidyverse)

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

```
res = InitMix()

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

res2 = FindCovaMix(PID = res$PID,
                   OutPath= "default",
                   VarsY = "Y1",
                   VarsC_Prior = "default",
                   VarsC_Fixed = "C5,C6",
                   Method = "single.factor",
                   Thr = 0.1)
res2$MixCovariables
```

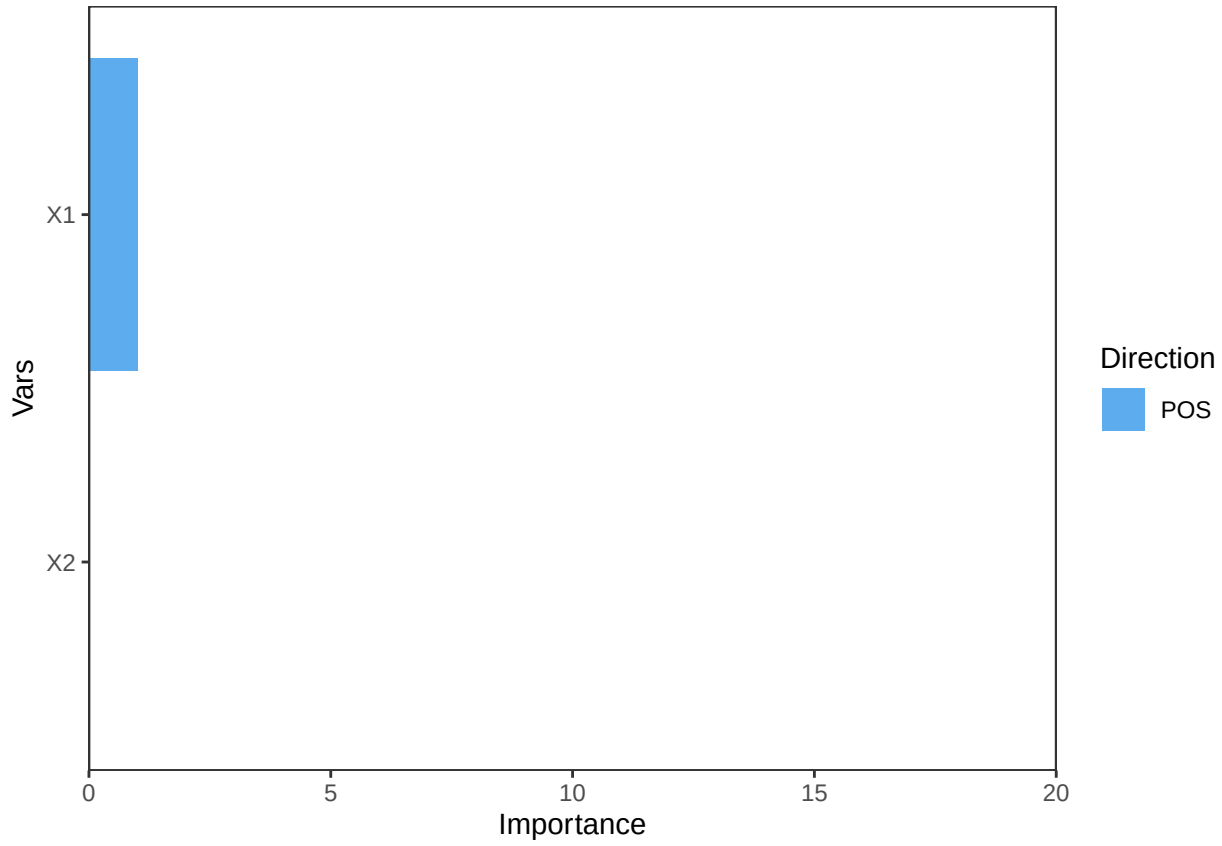
```
## [1] "C4" "C5" "C6"
```

```
res3 = MixMLR(PID = res$PID,
              OutPath= "default",
              VarsY = "Y1",
              VarsX = "all.x",
              IncCova = F,
              SelMethod = "lasso" ,
              PredType = "response" ,
              Family = "gaussian")
res3$Y1_lasso_vip
```

```
## # A tibble: 2 x 3
##   Variable Importance Sign
##   <chr>         <dbl> <chr>
```

```
## 1 X1           1.00   POS
## 2 X2           0.0209 POS
```

```
res4 = VizMixMLR(PID=res$PID,
                 OutPath= "default",
                 VarsY = "Y1",
                 SelMethod = 'lasso',
                 Brightness = "light",
                 Palette = "default1")
res4$Y1_lasso_importance_light_default1
```

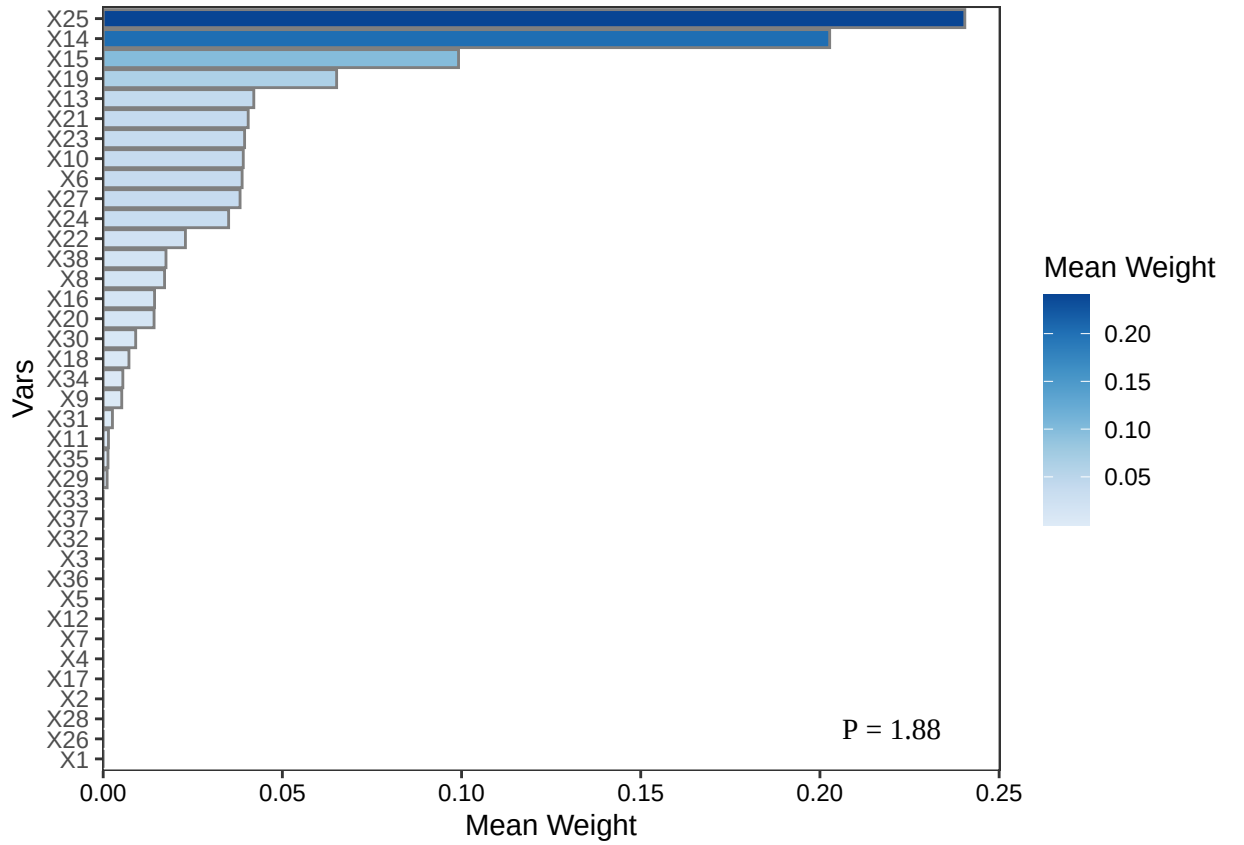



```
res5 = MixWQS(PID=res$PID,
              OutPath= "default",
              VarsY = "Y1",
              VarsX = "all.x" ,
              IncCova = F,
              Family = "gaussian" ,
              VarStrat = "none",
              RatioValidat = 0.3,
              q = 10,
              b=100,
              b1_pos = F,
              b1_constr = F)
res5$Y1_gaussian_Imp
```

```
##     mix_name  mean_weight
## X25      X25 2.404228e-01
```

```
## X14      X14 2.027116e-01
## X15      X15 9.916052e-02
## X19      X19 6.513869e-02
## X13      X13 4.202749e-02
## X21      X21 4.046160e-02
## X23      X23 3.945876e-02
## X10      X10 3.908749e-02
## X6        X6 3.876949e-02
## X27      X27 3.819521e-02
## X24      X24 3.500169e-02
## X22      X22 2.294915e-02
## X38      X38 1.752412e-02
## X8        X8 1.712935e-02
## X16      X16 1.434207e-02
## X20      X20 1.419808e-02
## X30      X30 9.069463e-03
## X18      X18 7.190387e-03
## X34      X34 5.481655e-03
## X9        X9 5.182469e-03
## X31      X31 2.585260e-03
## X11      X11 1.476624e-03
## X35      X35 1.341644e-03
## X29      X29 1.094139e-03
## X33      X33 4.314870e-08
## X37      X37 3.205410e-08
## X32      X32 3.190042e-08
## X3        X3 3.182883e-08
## X36      X36 3.145175e-08
## X5        X5 2.473607e-08
## X12      X12 2.222508e-08
## X7        X7 1.959676e-08
## X4        X4 7.793889e-09
## X17      X17 4.956954e-09
## X2        X2 4.868430e-09
## X28      X28 3.122512e-09
## X26      X26 1.322164e-09
## X1        X1 1.560702e-10
```

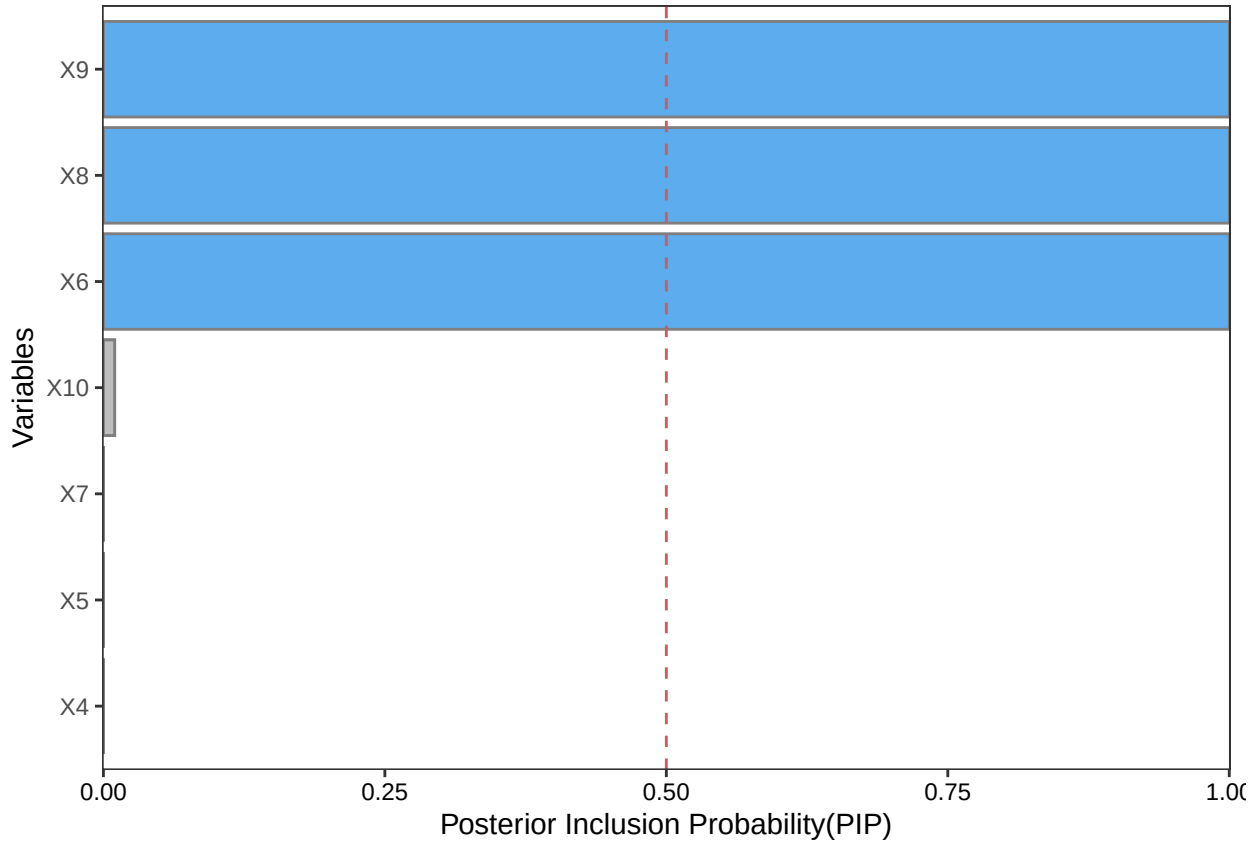
```
res6 = VizMixWQS(PID = res$PID,
                 OutPath= "default",
                 VarsY = "Y1",
                 Brightness = "dark",
                 Palette = "default1")
res6$Y1_gaussian_Imp_dark_default1
```




```
res7 = MixBKMR(PID = res$PID,
               OutPath= "default",
               VarsY = "Y1",
               VarsX = "X4,X5,X6,X7,X8,X9,X10",
               IncCova = F,
               Family = "gaussian" ,
               Group = F,
               Iter = 2000,
               qfixed = 0.5,
               qsbivar = "default" ,
               qsoverall = "default",
               qsdiff = "default")
res7$Y1_risks.overall
```

```
##    quantile        est       sd
## 1      0.25 -19.342570 49.27176
## 2      0.30 -12.972066 47.47622
## 3      0.35 -13.670789 48.16824
## 4      0.40  -2.537996 48.37987
## 5      0.45 -20.554091 70.10191
## 6      0.50   0.000000  0.00000
## 7      0.55 -10.558709 53.27296
## 8      0.60 -11.722467 51.65752
## 9      0.65 -25.440104 76.20959
## 10     0.70  -4.165882 78.07037
## 11     0.75 -15.774105 82.97824
```

```
res8 = VizMixBKMR(PID=res$PID,
                  OutPath= "default",
                  VarsY = "Y1",
                  Brightness = "dark",
                  Palette = "default1")
res8$Y1_pip.univar_dark_default1
```




```
FuncExit(PID = res$PID)
```

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