Package 'exmix'

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Title Analyze mixture effect of the various exposure factors.

Version 1.0.0

Description 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.

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NeedsCompilation no

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R topics documented:

FindCovaMix *Find covariates*

Description

Find covariates

Usage

```
FindCovaMix(PID, OutPath = "default", VarsY, VarsC_Prior = "default",
    VarsC_Fixed = NULL, Method = "single.factor", Thr = 0.1)
```

Arguments

PID	chr. Program ID. It must be the same with the PID generated by ExpoMixEffect
OutPath	chr. Output file directory, e.g. "D:/test". It should be noted that the slash symbol is "/", not "\". If "default", the current working directory will be set.
VarsY	chr. Outcome variable used for modeling. Only one variable can be entered.
VarsC_Prior	chr. Potential covariates needing further statistical test. The default value is all covariate variables listed in the data file.
VarsC_Fixed	chr. Covariate variables fixed in the model by users.
Method	chr. Methods for screening the covariates, including two options, i.e. "single.factor" and "two.stage".
Thr	num. Threshold of the P-value for screening the covariates. It is ranging 0.05-0.25. The defaults value is 0.1.

Value

A list containing the selected covariates.

Author(s)

Bin Wang

Examples

```
res <- InitMix()
   res = LoadMix(PID = res$PID, UseExample = "example#1")
```

FuncExit *End the module analysis*

Description

End the module analysis

Usage

```
FuncExit(PID)
```

Arguments

PID	chr. Program ID. It must be the same with the PID generated by any initial functions.

Value

Exit status

Author(s)

Bin Wang (corresponding author)

Examples

```
res = InitMix()
   res = LoadMix(PID = res$PID,UseExample = "example#1")
   FuncExit(PID = res$PID)
```

InitMix *Initialize ExpoMixEffect module*

Description

Initialize ExpoMixEffect module analysis. It can generate an R6 class object.

Usage

```
InitMix()
```

Details

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.

Value

An R6 class object.

Author(s)

Bin Wang (corresponding author)

Examples

```
res <- InitMix()
```

`LoadMix` *Load data file for ExpoMixEffect module*

Description

Load data file for ExpoMixEffect module

Usage

```
LoadMix(PID, UseExample = "default", DataPath = NULL, VocaPath = NULL)
```

Arguments

`PID`	chr. Program ID. It must be the same with the PID generated by ExpoMixEffect
`UseExample`	chr. Method of uploading data. If "default",user should upload their own data files, or use "example#1" provided by this module.
`DataPath`	chr. Input directory of data file, e.g. "D:/test/eg_data_biolink.xlsx". It should be noted that the slash symbol is "/", not "\".
`VocaPath`	chr. Input directory of vocabulary file, e.g. "D:/test/eg_voca_biolink.xlsx". It should be noted that the slash symbol is "/", not "\".

Value

An R6 class object containing the input data.

Author(s)

Bin Wang

Examples

```
res <- InitMix()
   res = LoadMix(PID = res$PID, UseExample = "example#1")
```

`MixBKMR` *Build the Bayesian Kernel Machine Regression (BKMR) model*

Description

Build the Bayesian Kernel Machine Regression (BKMR) model

Usage

```
MixBKMR(PID, OutPath = "default", VarsY, VarsX, IncCova,
    Family, Group = F,Iter = 2000, qfixed = 0.5, qsbivar = "default",
    qsoverall = "default", qsdiff = "default")
```

Arguments

`PID`	chr. Program ID. It must be the same with the PID generated by ExpoMixEffect
`OutPath`	chr. Output file directory, e.g. "D:/test". It should be noted that the slash symbol is "/", not "\". If "default", the current working directory will be set.
`VarsY`	chr. Outcome variable used for modeling. Only one variable can be entered.
`VarsX`	chr. Exposure variable used for modeling. The default option is "all.x" (All exposure variables are included). Users can also choose available variables. It should be noted that there is fixed format for the entering characters separated with comma and without space, e.g., "X1,X2,X3"
`IncCova`	lgl. T (or TRUE) and F (or FALSE). Whether to include the covariate selected in the function "FindCovaMix"
`Family`	chr. The link function for the regression model according the data type of outcomes, including "gaussian" for continuous variable, "binomial" for binary variable, and "poisson" for counting variable
`Group`	lgl. T (or TRUE) and F (or FALSE). Whether to use group indicators for fitting hierarchical variable selection. If "TRUE", the group name (GroupName) should be provided in the vocabulary data file.
`Iter`	num. Number of iterations for modeling. The default is 500. For more accurate and stable results, a minimum of 10,000 iteration is recommended.
`qfixed`	num. Quantile at which to fix the other predictors. The default is 0.5.
`qsbivar`	chr. Quantiles at which to fix the second variable. It should be noted that there is fixed format for the entering characters separated with comma and without space, e.g., the default character sequence is "0.1,0.5,0.9"
`qsoverall`	num. Quantiles at which to calculate the overall risk summary. It should be noted that there is fixed format for the entering characters separated with comma and without space, e.g., the default character sequence is "0.25,0.30,0.35,0.40,0.45,0.50,0.55,0.60,0.65,0.7
`qsdiff`	chr. Indicating the two quantiles for computing their effect difference. It should be noted that there is fixed format for the entering characters separated with comma and without space, e.g., the default character sequence is "0.25,0.75".

Value

A list containing the BKMR analysis results.

Author(s)

Bin Wang

Examples

```
res <- InitMix()
   res1 = LoadMix(PID = res$PID, UseExample = "example#1")
   res2 = MixBKMR(PID = res$PID, 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")
```

MixMLR *Build multiple linear regression (MLR) model*

Description

Build multiple linear regression (MLR) model

Usage

```
MixMLR(PID,OutPath = "default",VarsY,VarsX,IncCova = "F",
    SelMethod = "lasso",PredType = "response",Family)
```

Arguments

PID	chr. Program ID. It must be the same with the PID generated by ExpoMixEffect
OutPath	chr. Output file directory, e.g. "D:/test". It should be noted that the slash symbol is "/", not "\". If "default", the current working directory will be set.
VarsY	chr. Outcome variable used for modeling. Only one variable can be entered.
VarsX	chr. Exposure variable used for modeling. The default option is "all.x" (All exposure variables are included). Users can also choose available variables. It should be noted that there is fixed format for the entering characters separated with comma and without space, e.g., "X1,X2,X3"
IncCova	lgl. T (or TRUE) and F (or FALSE). Whether to include the covariate selected in the function "FindCovaMix"
SelMethod	chr. Method to select the important features to the final model. Options include "stepwise" (stepwise regression), "lasso" (Regularization regression of least absolute shrinkage and selection operator), and "enet" (Regularization regression of elastic net).
PredType	chr. Prediction type of the outcome variable, including "response" for the actual values and "prob" for outcome with binary variable.
Family	chr. The link function for the regression model according the data type of outcomes, including "gaussian" for continuous variable, "binomial" for binary variable, and "poisson" for counting variable

Value

A list containing the MLR analysis.

Author(s)

Bin Wang

Examples

```
res <- InitMix()
   res1 = LoadMix(PID = res$PID, UseExample = "example#1")
   res2 = MixMLR(PID = res$PID, VarsY = "Y1", VarsX = "all.x", IncCova = "F",
   SelMethod = "lasso", PredType = "response", Family = "gaussian")
```

`MixWQS` *Build weighted quantile sum regression (WQS) model*

Description

Build weighted quantile sum regression (WQS) model

Usage

```
MixWQS(PID, OutPath = "default", VarsY, VarsX, IncCova = "F", Family,
    VarStrat = "none",RatioValidat = 0.3,q = 10,b = 100,b1_pos = F,b1_constr = F)
```

Arguments

`PID`	chr. Program ID. It must be the same with the PID generated by ExpoMixEffect
`OutPath`	chr. Output file directory, e.g. "D:/test". It should be noted that the slash symbol is "/", not "\". If "default", the current working directory will be set.
`VarsY`	chr. Outcome variable used for modeling. Only one variable can be entered.
`VarsX`	chr. Exposure variable used for modeling. The default option is "all.x" (All exposure variables are included). Users can also choose available variables. It should be noted that there is fixed format for the entering characters separated with comma and without space, e.g., "X1,X2,X3"
`IncCova`	lgl. T (or TRUE) and F (or FALSE). Whether to include the covariate selected in the function "FindCovaMix"
`Family`	chr. The link function for the regression model according the data type of outcomes, including "gaussian" for continuous variable, "binomial" for binary variable, and "poisson" for counting variable.
`VarStrat`	chr. A factor variable used for stratifying for the model.
`RatioValidat`	num. Percentage of the dataset to be used to validate the model. If validation = 0 then the test dataset is used as validation dataset too. The default is 0.3.

q	num. Levels for ranking mixture variables, e.g. in quartiles (q = 4), deciles (q = 10), or percentiles (q = 100). The default is 10.
b	num. Number of bootstrap samples used in parameter estimation. The default is 100.
b1_pos	lgl. T (or TRUE) and F (or FALSE). Whether the beta values were positive to derive weights from to build models.
b1_constr	lgl. T (or TRUE) and F (or FALSE). A logial value that determines whether to apply positive (if b1_pos = TRUE) or negative (if b1_pos = FALSE) constraints in the optimization function for the weight estimation.

Value

A list containing the WQS analysis results.

Author(s)

Bin Wang

Examples

```
res <- InitMix()
   res1 = LoadMix(PID = res$PID, UseExample = "example#1")
   res3 = MixWQS(PID=res$PID, VarsY = "Y1", VarsX = "all.x", IncCova = "F",
   Family = "gaussian", VarStrat = "none", RatioValidat = 0.3,
   q = 10, b=100, b1_pos = 'F', b1_constr = 'F')
```

VizMixBKMR *Visualize the model results of Bayesian Kernel Machine Regression (BKMR)*

Description

Visualize the model results of Bayesian Kernel Machine Regression (BKMR)

Usage

```
VizMixBKMR(PID, OutPath = "default", VarsY, Brightness = "dark", Palette = "default1")
```

Arguments

PID	chr. Program ID. It must be the same with the PID generated by ExpoMixEffect
OutPath	chr. Output file directory, e.g. "D:/test". It should be noted that the slash symbol is "/", not "\". If "default", the current working directory will be set.
VarsY	chr. Outcome variable used for modeling. Only one variable can be entered.
Brightness	chr. Visualization brightness. Available options include "light" and "dark".
Palette	chr. Visualization palette. Available options include "default1", "default2" and several journal preference styles (i.e., cell, nature, science, lancet, nejm, and jama).

Value

A list containing the BKMR analysis results' plot.

Author(s)

Bin Wang

Examples

```
res <- InitMix()
   res1 = LoadMix(PID = res$PID, UseExample = "example#1")
   res2 = MixBKMR(PID = res$PID, 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")
   res3 = VizMixBKMR(PID=res$PID, VarsY = "Y1",Brightness = "dark",Palette = "default1")
```

VizMixMLR *Visualize the model results*

Description

Visualize the results of multiple linear regression (MLR) model

Usage

```
VizMixMLR(PID,OutPath = "default",VarsY,SelMethod,Brightness = "light",Palette = "default1")
```

Arguments

PID	chr. Program ID. It must be the same with the PID generated by ExpoMixEffect
OutPath	chr. Output file directory, e.g. "D:/test". It should be noted that the slash symbol is "/", not "\". If "default", the current working directory will be set.
VarsY	chr. Outcome variable used for modeling. Only one variable can be entered.
SelMethod	chr. Method to select the important features to the final model. Options include "stepwise" (stepwise regression), "lasso" (Regularization regression of least absolute shrinkage and selection operator), and "enet" (Regularization regression of elastic net).
Brightness	chr. Visualization brightness. Available options include "light" and "dark".
Palette	chr. Visualization palette. Available options include "default1", "default2" and several journal preference styles (i.e., cell, nature, science, lancet, nejm, and jama).

Value

A list containing the MLR analysis plot.

Author(s)

Bin Wang

Examples

```
res <- InitMix()
   res1 = LoadMix(PID = res$PID, UseExample = "example#1")
   res2 = MixMLR(PID = res$PID, VarsY = "Y1", VarsX = "all.x",
   IncCova = "F", SelMethod = "lasso", PredType = "response", Family = "gaussian")
   res3 = VizMixMLR(PID=res$PID, VarsY = "Y1", SelMethod = 'lasso',
   Brightness = "light", Palette = "default1")
```

VizMixWQS *Visualize results of weighted quantile sum regression (WQS) model*

Description

Visualize results of weighted quantile sum regression (WQS) model

Usage

```
VizMixWQS(PID, OutPath = "default", VarsY, Brightness = "dark", Palette = "default1")
```

Arguments

PID	chr. Program ID. It must be the same with the PID generated by ExpoMixEffect
OutPath	chr. Output file directory, e.g. "D:/test". It should be noted that the slash symbol is "/", not "\". If "default", the current working directory will be set.
VarsY	chr. Outcome variable used for modeling. Only one variable can be entered.
Brightness	chr. Visualization brightness. Available options include "light" and "dark".
Palette	chr. Visualization palette. Available options include "default1", "default2" and several journal preference styles (i.e., cell, nature, science, lancet, nejm, and jama).

Value

A list containing the WQS analysis results' plot.

Author(s)

Bin Wang

Examples

```
res <- InitMix()
   res1 = LoadMix(PID = res$PID, UseExample = "example#1")
   res2 = MixWQS(PID=res$PID, VarsY = "Y1", VarsX = "all.x",
   IncCova = "F",Family = "gaussian", VarStrat = "none", RatioValidat = 0.3,
   q = 10, b=100, b1_pos = 'F', b1_constr = 'F')
   res3 = VizMixWQS(PID = res$PID,  VarsY = "Y1",
   Brightness = "dark",Palette = "default1")
```

Index