

# Package ‘longitudinalANAL’

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**Type** Package

**Title** Longitudinal Data Analysis

**Version** 0.2

**Description** Regression analysis of mixed sparse synchronous and asynchronous longitudinal covariates. Please cite the manuscripts corresponding to this package: Sun, Z. et al. (2023) <[doi:10.48550/arXiv.2305.17715](https://doi.org/10.48550/arXiv.2305.17715)> and Liu, C. et al. (2023) <[doi:10.48550/arXiv.2305.17662](https://doi.org/10.48550/arXiv.2305.17662)>.

**License** GPL-3

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|     |                                   |
|-----|-----------------------------------|
| lda | <i>Longitudinal data analysis</i> |
|-----|-----------------------------------|

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**Description**

This function provide regression analysis of mixed sparse synchronous and asynchronous longitudinal covariates.

**Usage**

```
lda(data_res, data_cov, N, bd, omit, method)
```

**Arguments**

|          |                                                                                                                                                                                                                                                                        |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| data_res | An object of class tibble. The structure of the tibble must be: tibble(id_y=ID, ty=measurement time for response, y=observation for response, x=matrix(observation for synchronous covariates), x_add=matrix(observation for uninterested synchronous covariates)).    |
| data_cov | An object of class tibble. The structure of the tibble must be: tibble(id_z=ID, tz=measurement time for response, z=matrix(observation for asynchronous covariates)).                                                                                                  |
| N        | An object of class integer. The sample size.                                                                                                                                                                                                                           |
| bd       | An object of class vector. If use auto bandwidth selection, the structure of the vector must be: d=c(the maximum bandwidth, the minimum bandwidth, the fold of cross-validation, the number of bandwidth divided). If use fixed bandwidth, bd=c(the chosen bandwidth). |
| omit     | An object of class integer indicating the method used to do estimation for synchronous covariates. If use plm method, omit=1; if use centering method, omit=2; if use additional covariates information, omit=3.                                                       |
| method   | An object of class integer indicating the method used to do estimation for asynchronous covariates. If only deal with omit variable, method=0; if use two-stage method, method=1; if use kernel smoothing, method=2.                                                   |

**Value**

a list with the following elements:

|     |                                                                |
|-----|----------------------------------------------------------------|
| est | The estimation for the corresponding parameters.               |
| se  | The estimation of standard error for the estimated parameters. |

**Examples**

```
library(MASS)
library(tibble)
library(dplyr)
N=100
```

```

ty=tz=y=x=z=id_y=id_z=list()
a=b=g=1
ny=rpois(N,5)+1
nz=rpois(N,5)+1
for(i in 1:N){
  ty[[i]]=as.matrix(runif(ny[i]))
  tz[[i]]=as.matrix(runif(nz[i]))
  t.temp=rbind(tz[[i]],ty[[i]])
  n.temp=nz[i]+ny[i]
  corr=exp(-abs(rep(1,n.temp)%*%t(t.temp)-t.temp)%*%t(rep(1,n.temp))))
  corr.e=2^(-abs(rep(1,n.temp)%*%t(t.temp)-t.temp)%*%t(rep(1,n.temp))))
  MX=t.temp^.5
  MZ=rep(0, n.temp)
  x.temp=mvnorm(1,MX,corr)
  z.temp=mvnorm(1,MZ, corr)
  z[[i]]=as.matrix(z.temp[1:nz[i]])
  x[[i]]=as.matrix(x.temp[-(1:nz[i])])
  id_z[[i]]=rep(i,nz[i])
  id_y[[i]]=rep(i,ny[i])
  y.temp=a+g*z.temp+x.temp*b+as.matrix(mvnorm(1,rep(0,n.temp),corr.e))
  y[[i]]=as.matrix(y.temp[-(1:nz[i])])
}
data_cov=tibble(id_z=unlist(id_z),tz=unlist(tz),z=matrix(unlist(z),length(unlist(z))))
data_res=tibble(id_y=unlist(id_y),ty=unlist(ty),x=matrix(unlist(x),length(unlist(x))),y=unlist(y))
bd=0.1
omit=1
method=1
lda(data_res,data_cov,N,bd,omit,method)

```

ldatv

*Longitudinal data analysis*

## Description

This function provide regression analysis of mixed sparse synchronous and asynchronous longitudinal covariates with time-varying coefficients.

## Usage

```
ldatv(data_res, data_cov, time, N, bd, method, scb)
```

## Arguments

- |          |                                                                                                                                                                                                                                                                                   |
|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| data_res | An object of class tibble. The structure of the tibble must be: <code>tibble(id_y=ID, ty=measurement time for response, y=observation for response, x=matrix(observation for synchronous covariates), x_add=matrix(observation for uninterested synchronous covariates))</code> . |
| data_cov | An object of class tibble. The structure of the tibble must be: <code>tibble(id_z=ID, tz=measurement time for response, z=matrix(observation for asynchronous covariates))</code> .                                                                                               |

|        |                                                                                                                                                                                                                                                                                                                                                                         |
|--------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| time   | An object of class vector. The interest time.                                                                                                                                                                                                                                                                                                                           |
| N      | An object of class integer. The sample size.                                                                                                                                                                                                                                                                                                                            |
| bd     | An object of class vector. If use auto bandwidth selection, the structure of the vector must be: $bd=c$ (the maximum bandwidth for $h_1$ , the minimum bandwidth for $h_1$ , the maximum bandwidth for $h_2$ , the minimum bandwidth for $h_2$ , the fold of cross-validation, the number of bandwidth divided). If use fixed bandwidth, $bd=c$ (the chosen bandwidth). |
| method | An object of class integer indicating the method used to do estimation for asynchronous covariates. If use one-stage method, $method=1$ ; if use two-stage method with centering method for the first stage, $method=1$ ; if use two-stage method with time-varying method for the first stage, $method=2$ .                                                            |
| scb    | An object of class vector. If need to construct the simultaneous confidence band, the structure of the vector must be: $c(\alpha=\text{desirable confidence level}, B=\text{repeat times})$ . Otherwise, $scb=0$ .                                                                                                                                                      |

### Value

a list with the following elements:

|           |                                                                                                                           |
|-----------|---------------------------------------------------------------------------------------------------------------------------|
| est.b     | The estimation for the parameter of synchronous covariates.                                                               |
| est.g     | The estimation for the parameter of asynchronous covariates.                                                              |
| se.b      | The estimation of standard error for the parameter of synchronous covariates.                                             |
| se.g      | The estimation of standard error for the parameter of asynchronous covariates.                                            |
| c_alpha_x | The empirical percentile used to construct the simultaneous confidence band for the parameter of synchronous covariates.  |
| c_alpha_z | The empirical percentile used to construct the simultaneous confidence band for the parameter of asynchronous covariates. |

### Examples

```
library(dplyr)
library(MASS)
library(tibble)
N=400
ty=tz=y=x1=z=id_y=id_z=list()
beta<-function(t){
  0.3*(t-0.4)^2
}
gamma<-function(t){
  sin(2*pi*t)
}
ny=rpois(N,5)+1
nz=rpois(N,5)+1
for(i in 1:N){
  ty[[i]]=as.matrix(runif(ny[i]))
  tz[[i]]=as.matrix(runif(nz[i]))
  t.temp=rbind(tz[[i]],ty[[i]])
  n.temp=nz[i]+ny[i]
```

```

corr=exp(-abs(rep(1,n.temp)%*%t(t.temp)-t.temp%*%t(rep(1,n.temp))))
corr.e=2^(-abs(rep(1,n.temp)%*%t(t.temp)-t.temp%*%t(rep(1,n.temp))))
MX=rep(0, n.temp)
MZ= 2*(t.temp-0.5)^2
x.temp=mvnrm(1,MX,corr)
z.temp=mvnrm(1,MZ, corr)
z[[i]]=as.matrix(z.temp[1:nz[i]])
x[[i]]=as.matrix(x.temp[-(1:nz[i])])
id_z[[i]]=rep(i,nz[i])
id_y[[i]]=rep(i,ny[i])
y.temp=gamma(t.temp)*z.temp+beta(t.temp)*x.temp+as.matrix(mvnrm(1,rep(0,n.temp),corr.e))
y[[i]]=as.matrix(y.temp[-(1:nz[i])])
}
data_cov=tibble(id_z=unlist(id_z),tz=unlist(tz),z=matrix(unlist(z),length(unlist(z))))
data_res=tibble(id_y=unlist(id_y),ty=unlist(ty),x=matrix(unlist(x),length(unlist(x))), y=unlist(y))
ldatv(data_res,data_cov,time=0.3,N,bd=c(N^(-0.5),N^(-0.5)),method=1,scb=0)

```

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