Package ‘CMFCAM’

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Title Copula, Multistate, Frailty for Causal Analysis Modle

Version 1.0

Description The packages for 'Unified semicompeting risks analysis of hepatitis natural history through mediation modeling'. The main functions are CP_MLE (calculate the causal effect from copula model by MLE), CP_Ustat (calculate the causal effect from copula model by U-statistics), Frailty (calculate the causal effect from frailty model) and M_state (calculate the causal effect from multistate model).

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R topics documented:

`CP_MLE` *Estimating the direct and indirect of the Copula model by MLE*

Description

Estimating the direct and indirect of the Copula model by MLE

Usage

```
CP_MLE(data, P.time, int_theta, tol, step)
```

Arguments

`data`	data.frame(X1,X2,D,Z)
`P.time`	interpolation time can be vector or scalar

Examples

```
data=meta.gen(500,theta_0=0.5,theta_1=0.5,L1=0.5,L2=0.5,L3=1,b01=1,b02=0,b03=0,cc=2,dd="uniform")
P.time=seq(0,1,by=0.01)
ans=CP_MLE(data,P.time,int_theta=c(0.5,0.5),tol=0.01,step=50)
plot(P.time,ans$DE,type="l",ylim=c(-0.5,0.5))
points(P.time,ans$DE+ans$DE_sd,type="l",ylim=c(-0.5,0.5))
points(P.time,ans$DE-ans$DE_sd,type="l",ylim=c(-0.5,0.5))
points(P.time,ans$IE,type="l",ylim=c(-0.5,0.5),col=2)
points(P.time,ans$IE+ans$IE_sd,type="l",ylim=c(-0.5,0.5),col=2)
points(P.time,ans$IE-ans$IE_sd,type="l",ylim=c(-0.5,0.5),col=2)
legend(0,0.45,c("direct effect","indirect effect"),col=1:2,lty=1)
```

`cp_u` *Estimating the direct and indirect of the Copula model by U-statistics*

Description

Estimating the direct and indirect of the Copula model by U-statistics

Usage

```
cp_u(data, P.time)
```

Arguments

`data`	data.frame(X1,X2,D,Z)
`interpolation`	time can be vector or scalar
`int_theta`	initial value of theta for iteration, nonnegative values vector of length 2
`tol`	maximum tolerance of change during the iteration
`step`	maximum number of the iteration

Examples

```
data=meta.gen(500,theta_0=0.5,theta_1=0.5,L1=0.5,L2=0.5,L3=1,b01=1,b02=0,b03=0,cc=2,dd="uniform")
P.time=seq(0,1,by=0.01)
ans=cp_u(data,P.time)
plot(P.time,ans$DE,type="l",ylim=c(-0.5,0.5))
points(P.time,ans$IE,type="l",ylim=c(-0.5,0.5),col=2)
legend(0,0.45,c("direct effect","indirect effect"),col=1:2,lty=1)
```

`CP_Ustat` *Estimating the direct and indirect of the Copula model by U-statistics, calculate the variance by bootstrapping*

Description

Estimating the direct and indirect of the Copula model by U-statistics, calculate the variance by bootstrapping

Usage

```
CP_Ustat(data, P.time)
```

Arguments

`data`	data.frame(X1,X2,Z,D)
`P.time`	interpolation time can be vector or scalar

Examples

```
data=meta.gen(500,theta_0=0.5,theta_1=0.5,L1=0.5,L2=0.5,L3=1,b01=1,b02=0,b03=0,cc=2,dd="uniform")
P.time=seq(0,1,by=0.01)
ans=CP_Ustat(data,P.time)
plot(P.time,ans$DE,type="l",ylim=c(-0.5,0.5))
points(P.time,ans$DE+ans$DE_sd,type="l",ylim=c(-0.5,0.5))
points(P.time,ans$DE-ans$DE_sd,type="l",ylim=c(-0.5,0.5))
points(P.time,ans$IE,type="l",ylim=c(-0.5,0.5),col=2)
points(P.time,ans$IE+ans$IE_sd,type="l",ylim=c(-0.5,0.5),col=2)
points(P.time,ans$IE-ans$IE_sd,type="l",ylim=c(-0.5,0.5),col=2)
legend(0,0.45,c("direct effect","indirect effect"),col=1:2,lty=1)
```

`Frailty` *Estimating the direct and indirect of the frailty model*

Description

Estimating the direct and indirect of the frailty model

Usage

```
Frailty(data, P.time, int_theta, tol, step)
```

Arguments

`data`	data.frame(X1,X2,D,Z)
`int_theta`	initial value of theta for iteration, nonnegative values vector of length 2
`tol`	maximum tolerance of change during the iteration
`step`	maximum number of the iteration
`interpolation`	time can be vector or scalar

Examples

```
data=meta.gen(500,theta_0=0.5,theta_1=0.5,L1=0.5,L2=0.5,L3=1,b01=1,b02=0,b03=0,cc=2,dd="uniform")
P.time=seq(0,1,by=0.01)
ans=Frailty(data,P.time,int_theta=c(0.5,0.5),tol=0.01,step=50)
plot(P.time,ans$DE,type="l",ylim=c(-0.5,0.5))
points(P.time,ans$DE+ans$DE_sd,type="l",ylim=c(-0.5,0.5))
points(P.time,ans$DE-ans$DE_sd,type="l",ylim=c(-0.5,0.5))
points(P.time,ans$IE,type="l",ylim=c(-0.5,0.5),col=2)
points(P.time,ans$IE+ans$IE_sd,type="l",ylim=c(-0.5,0.5),col=2)
points(P.time,ans$IE-ans$IE_sd,type="l",ylim=c(-0.5,0.5),col=2)
legend(0,0.45,c("direct effect","indirect effect"),col=1:2,lty=1)
```

`meta.gen` *generating the data with 1/2 bivariate exposure from the frailty model by three exponential distributions*

Description

generating the data with 1/2 bivariate exposure from the frailty model by three exponential distributions

Usage

```
meta.gen(
  n,
  theta_0,
  theta_1,
  L1,
  L2,
  L3,
  b01,
  b02,
  b03,
  cc = 2,
  dd = "uniform"
)
```

Arguments

n	sample size (even)
theta_0	theta for Z=1
theta_1	theta for Z=2
L1	lambda for genarate T1
L2	lambda for generate T2 without given T1
L3	lambda for generate T2 given T1
b01	effect from Z to T1
b02	effect from Z to T2
b03	effect from T1 to T2
cc	parameter for generating the censoring time, the regulator censoring rate

dd	set "uniform" for U(0,cc); set weibull for weibull(shape=5,scale=cc)
output	X1,X2,Z and D are observed mediated, terminal event times exposure and censoring index (1/0 for failure and censored)

Examples

```
meta.gen(500,theta_0=1,theta_1=0.5,L1=1,L2=1,L3=1,b01=0.5,b02=0,b03=1,cc=2,dd="uniform")
```

`ms` *Estimating the direct and indirect of the Multistate model.*

Description

Estimating the direct and indirect of the Multistate model.

Usage

```
ms(data, P.time)
```

Arguments

data	data.frame(X1,X2,D,Z)
P.time	interpolation time can be vector or scalar

Examples

```
data=meta.gen(500,theta_0=0.5,theta_1=0.5,L1=0.5,L2=0.5,L3=1,b01=1,b02=0,b03=0,cc=2,dd="uniform")
P.time=seq(0,1,by=0.01)
ans=ms(data,P.time)
plot(P.time,ans$DE,type="l",ylim=c(-0.5,0.5))
points(P.time,ans$IE,type="l",ylim=c(-0.5,0.5),col=2)
legend(0,0.45,c("direct effect","indirect effect"),col=1:2,lty=1)
```

`M_state` *Estimating the direct and indirect of the Multistate model. Obtaining the variance by bootstrapping*

Description

Estimating the direct and indirect of the Multistate model. Obtaining the variance by bootstrapping

Usage

```
M_state(data, P.time)
```

Arguments

data	data.frame(X1,X2,D,Z)
P.time	interpolation time can be vector or scalar

Examples

```
data=meta.gen(500,theta_0=0.5,theta_1=0.5,L1=0.5,L2=0.5,L3=1,b01=1,b02=0,b03=0,cc=2,dd="uniform")
P.time=seq(0,1,by=0.01)
ans=M_state(data,P.time)
plot(P.time,ans$DE,type="l",ylim=c(-0.5,0.5))
points(P.time,ans$DE+ans$DE_sd,type="l",ylim=c(-0.5,0.5))
points(P.time,ans$DE-ans$DE_sd,type="l",ylim=c(-0.5,0.5))
points(P.time,ans$IE,type="l",ylim=c(-0.5,0.5),col=2)
points(P.time,ans$IE+ans$IE_sd,type="l",ylim=c(-0.5,0.5),col=2)
points(P.time,ans$IE-ans$IE_sd,type="l",ylim=c(-0.5,0.5),col=2)
legend(0,0.45,c("direct effect","indirect effect"),col=1:2,lty=1)
```

---

pLA *predicting the value for one to one vector*

Description

predicting the value for one to one vector

Usage

```
pLA(yy, tt, LL)
```

Arguments

yy	any time you want to interpolate
tt	time or x value with same length of LL, must >0
LL	value as f(tt)

Examples

```
x=seq(0,0.5,by=0.01)
LL=pnorm(x,0,1)
pLA(c(0,0.1,0.25,0.01,3),x,LL)
```

Xu2010 *Estimating the parameters of the frailty model*

Description

Estimating the parameters of the frailty model

Usage

```
Xu2010(T1, T2, d2, int_theta, tol = tol, step)
```

Arguments

T1	observed mediator event time (vector)
T2	observed terminal event time (vector)
d2	1 for terminal event occured 0 for censored (vector)
int_theta	initial value (>0) for theta used for iteration
tol	maximum tolerance of change during the iteration
step	maximum number of the iteration

Examples

```
data=meta.gen(500,theta_0=0.5,theta_1=0.5,L1=1,L2=1,L3=1,b01=0,b02=0,b03=0,cc=2,dd="uniform")
ans=Xu2010(data$X1,data$X2,data$D, int_theta=1 ,tol=0.01,step=50)
ans
```

Xu2010_rest *Estimating the parameters of the frailty model*

Description

Estimating the parameters of the frailty model

Usage

```
Xu2010_rest(T1, T2, d2, int_theta, tol = 0.01, step)
```

Arguments

T1	observed mediator event time (vector)
T2	observed terminal event time (vector)
d2	1 for terminal event occured 0 for censored (vector)
int_theta	initial value (>0) for theta used for iteration
tol	maximum tolerance of change during the iteration
step	maximum number of the iteration

Examples

```
data=meta.gen(500,theta_0=0.5,theta_1=0.5,L1=1,L2=1,L3=1,b01=0,b02=0,b03=0,cc=2,dd="uniform")
ans=Xu2010_rest(data$X1,data$X2,data$D, int_theta=1 ,tol=0.01,step=50)
ans
```

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