Package 'targeted'

May 15, 2020

Type Package

Title Targeted Inference

Version 0.1.1

Date 2020-05-10

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Description Various methods for targeted and semiparametric inference including
augmented inverse probability weighted estimators for missing data and
causal inference (Bang and Robins (2005) <doi:10.1111/j.1541-0420.2005.00377.x>)
and estimators for risk differences and relative risks (Richardson et al. (2017)
<doi:10.1080/01621459.2016.1192546>).

Depends R (>= 3.3), lava (>= 1.6.6)

Suggests testthat (>= 0.11), knitr, rmarkdown

URL https://kkholst.github.io/targeted/

BugReports https://github.com/kkholst/targeted/issues

License Apache License (== 2.0)

Imports methods, Rcpp (>= 1.0.0), optimx, futile.logger

LinkingTo Rcpp, RcppArmadillo

LazyLoad yes

NeedsCompilation yes

SystemRequirements C++11

ByteCompile yes

RcppModules riskregmodel, dcmodel

Encoding UTF-8

RoxygenNote 7.1.0

VignetteBuilder knitr

Repository CRAN

Date/Publication 2020-05-15 15:05:44 UTC

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`targeted-package` *Targeted inference*

Description

Methods for targeted and semiparametric inference including augmented inverse probability weighted estimators for missing data and causal inference.

Author(s)

Klaus K. Holst Maintainer: <klaus@holst.it>

Examples

```
example(riskreg)

example(ace)
```

`ace` *AIPW estimator for Average Causal Effect*

Description

Augmented Inverse Probability Weighting estimator for the Average Causal Treatment Effect.

Usage

```
ace(
  formula,
  data,
  weights,
  binary = TRUE,
  nuisance = NULL,
  propensity = nuisance,
  all,
```

```
  missing = FALSE,
  labels = NULL,
  ...
)
```

Arguments

formula	Formula (see details below)
data	data.frame
weights	optional frequency weights
binary	Binary response (default TRUE)
nuisance	outcome regression formula
propensity	propensity model formula
all	If TRUE all standard errors are calculated (default TRUE when exposure only has two levels)
missing	If TRUE a missing data (AIPW) estimator is returned
labels	Optional treatment labels
...	Additional arguments to lower level functions

Details

The formula may either be specified as: response ~ treatment | nuisance-formula | propensity-formula

For example: `ace(y~a | x+z | x*z,data=...)`

Alternatively, as a list: `ace(list(y~a,~x+z,~x*z),data=...)`

Or using the nuisance (and propensity argument): `ace(y~a,nuisance=~x+z,...)`

Value

An object of class 'ace.targeted' is returned. See targeted-class for more details about this class and its generic functions.

Author(s)

Klaus K. Holst

Examples

```
m <- lvm(y ~ a+x, a~x)
distribution(m,~ a+y) <- binomial.lvm()
d <- sim(m,1e3,seed=1)

a <- ace(y ~ a, nuisance=~x, data=d)
summary(a)

# Multiple treatments
m <- lvm(y ~ a+x, a~x)
```

```
distribution(m,~ y) <- binomial.lvm()
m <- ordinal(m, K=4, ~a)
transform(m, ~a) <- factor
d <- sim(m,1e4)
(a <- ace(y~a|a*x|x, data=d))

# Comparison with randomized experiment
m0 <- cancel(m, a~x)
d0 <- sim(m0,2e5)
lm(y~a-1,d0)

# Choosing a different contrast for the association measures
summary(a, contrast=c(2,4))
```

`riskreg` *Risk regression*

Description

Risk regression with binary exposure and nuisance model for the odds-product.

Let A be the binary exposure, V the set of covariates, and Y the binary response variable, and define $p_a(v) = P(Y = 1 \mid A = a, V = v), a \in \{0, 1\}$.

The **target parameter** is either the *relative risk*

$$\mathrm{RR}(v) = \frac{p_1(v)}{p_0(v)}$$

or the *risk difference*

$$\mathrm{RD}(v) = p_1(v) - p_0(v)$$

We assume a target parameter model given by either

$$\log\{RR(v)\} = \alpha^t v$$

or

$$\operatorname{arctanh}\{RD(v)\} = \alpha^t v$$

and similarly a working linear **nuisance model** for the *odds-product*

$$\phi(v) = \log\left(\frac{p_0(v)p_1(v)}{(1-p_0(v))(1-p_1(v))}\right) = \beta^t v$$

.

A **propensity model** for $E(A = 1|V)$ is also fitted using a logistic regression working model

$$\operatorname{logit}\{E(A = 1 \mid V = v)\} = \gamma^t v.$$

If both the odds-product model and the propensity model are correct the estimator is efficient. Further, the estimator is consistent in the union model, i.e., the estimator is double-robust in the sense that only one of the two models needs to be correctly specified to get a consistent estimate.

Usage

```
riskreg(
  formula,
  target = NULL,
  nuisance = NULL,
  propensity = nuisance,
  data,
  weights,
  type = "rr",
  optimal = TRUE,
  std.err = TRUE,
  start = NULL,
  semi = TRUE,
  ...
)
```

Arguments

formula	formula (see details below)
target	(optional) target model (formula)
nuisance	nuisance model (formula)
propensity	propensity model (formula)
data	data.frame
weights	optional weights
type	type of association measure (rd og rr)
optimal	If TRUE optimal weights are calculated
std.err	If TRUE standard errors are calculated
start	optional starting values
semi	Semi-parametric (double-robust) estimate (FALSE gives MLE)
...	additional arguments to unconstrained optimization routine (nlminb)

Details

The 'formula' argument should be given as `response ~ exposure | target-formula | nuisance-formula` or `response ~ exposure | target | nuisance | propensity`

E.g., `riskreg(y ~ a | 1 | x+z | x+z,data=...)`

Alternatively, the model can specifed using the target, nuisance and propensity arguments: `riskreg(y ~ a,target=~1,nuisance=~x+z,...)`

The `riskreg_fit` function can be used with matrix inputs rather than formulas.

Value

An object of class '`riskreg.targeted`' is returned. See `targeted-class` for more details about this class and its generic functions.

Author(s)

Klaus K. Holst

References

Richardson, T. S., Robins, J. M., & Wang, L. (2017). On modeling and estimation for the relative risk and risk difference. Journal of the American Statistical Association, 112(519), 1121–1130. http://dx.doi.org/10.1080/01621459.2016.1192546

Examples

```
m <- lvm(a[-2] ~ x,
        lp.target[1] ~ 1,
        lp.nuisance[-1] ~ 2*x)
distribution(m,~a) <- binomial.lvm("logit")
m <- binomial.rr(m, "y","a","lp.target","lp.nuisance")
d <- sim(m,5e2,seed=1)

I <- model.matrix(~1, d)
X <- model.matrix(~1+x, d)
with(d, riskreg_mle(y, a, I, X, type="rr"))

with(d, riskreg_fit(y, a, nuisance=X, propensity=I, type="rr"))
riskreg(y ~ a | 1 | x ,  data=d, type="rr")

## Model with same design matrix for nuisance and propensity model:
with(d, riskreg_fit(y, a, nuisance=X, type="rr"))

a <- riskreg(y ~ a, nuisance=~x,  data=d, type="rr")
a
```

---

targeted-class *targeted class object*

Description

The functions riskreg and ace returns an object of the type targeted.

An object of class 'targeted' is a list with at least the following components:

estimate An estimate object with the target parameter estimates (see estimate.default)

opt Object returned from the applied optimization routine

npar number of parameters of the model (target and nuisance)

type String describing the model

Value

objects of the S3 class 'targeted'

S3 generics

The following S3 generic functions are available for an object of class `targeted`:

- `coef`Extract target coefficients of the estimated model.
- `vcov`Extract the variance-covariance matrix of the target parameters.
- `iid`Extract the estimated influence function.
- `print`Print estimates of the target parameters.
- `summary`Extract information on both target parameters and estimated nuisance model.'

See Also

`riskreg`, `ace`

Examples

```
## See example(riskreg) for examples
```

Us *For internal use*

Description

For internal use

Author(s)

Klaus K. Holst

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