

Package: tmle3mediate (via r-universe)

October 29, 2024

Title Targeted Learning for Causal Mediation Analysis

Version 0.0.3

Maintainer Nima Hejazi <nh@nimahejazi.org>

Description Targeted maximum likelihood (TML) estimation of population-level causal effects in mediation analysis. The causal effects are defined by joint static or stochastic interventions applied to the exposure and the mediator. Targeted doubly robust estimators are provided for the classical natural direct and indirect effects, as well as the more recently developed population intervention direct and indirect effects.

Depends R (>= 3.4.0)

Imports R6, uuid, methods, data.table, assertthat, sl3 (>= 1.4.2), tmle3 (>= 0.2.0)

Suggests testthat, knitr, rmarkdown, covr, here, stats, stringr, ggplot2, dplyr, Rsolnp, nnls, speedglm, hal9001, medshift, mma

Remotes github::tlverse/sl3, github::tlverse/tmle3, github::nhejazi/medshift

License GPL-3

URL <https://tlverse.org/tmle3mediate>

BugReports <https://github.com/tlverse/tmle3mediate/issues>

Encoding UTF-8

LazyData true

VignetteBuilder knitr

RoxygenNote 7.1.1.9001

Roxygen list(markdown = TRUE, r6 = FALSE)

Repository <https://ictml-project.r-universe.dev>

RemoteUrl <https://github.com/tlverse/tmle3mediate>

RemoteRef HEAD

RemoteSha 70d1151c4adb54d044f355d06d07bcaeb7f8ae07

Contents

LF_ipsi	2
Param_medshift	3
Param_NDE	4
Param_NIE	5
tmle3_Spec_medshift	5
tmle3_Spec_NDE	6
tmle3_Spec_NIE	6
tmle_medshift	6
tmle_NDE	7
tmle_NIE	8
Index	9

LF_ipsi

Likelihood Factor for Incremental Propensity Score Interventions

Description

Likelihood Factor for Incremental Propensity Score Interventions

Format

R6Class object.

Value

LF_base object.

Constructor

```
define_lf(LF_ipsi, name, type = "density", likelihood_base, shift_param, treatment_task,
control_task, ...)
```

`name` A character, giving the name of the likelihood factor. Should match a node name in the nodes specified by the `npsem` slot of `tmle3_Task`.

`likelihood_base` A trained `Likelihood` object, for use in generating a re-scaled likelihood factor.

`shift_param` A numeric, specifying the magnitude of the desired incremental propensity score shift (a multiplier of the odds of receiving treatment).

`treatment_task` A `tmle3_Task` object created by setting the intervention to the treatment condition: `do(A = 1)`.

`control_task` A `tmle3_Task` object created by setting the intervention to the control condition: `do(A = 0)`.

... Not currently used.

Fields

likelihood_base A trained [Likelihood](#) object, for use in generating a re-scaled likelihood factor.

shift_param A numeric, specifying the magnitude of the desired incremental propensity score shift (a multiplier of the odds of receiving treatment).

treatment_task A [tmle3_Task](#) object created by setting the intervention to the treatment condition: `do(A = 1)`.

control_task A [tmle3_Task](#) object created by setting the intervention to the control condition: `do(A = 0)`.

... Additional arguments passed to the base class.

References

"Nonparametric Causal Effects Based on Incremental Propensity Score Interventions." Kennedy, Edward H (2019). Journal of the American Statistical Association. <https://doi.org/10.1080/01621459.2017.1422737>

"Causal Mediation Analysis for Stochastic Interventions" Díaz, Iván and Hejazi, Nima S (2020). Journal of the Royal Statistical Society, Series B. <https://doi.org/10.1111/rssb.12362>

 Param_medshift

Parameter for the Population Intervention (In)direct Effects

Description

Parameter definition class. See <https://doi.org/10.1111/rssb.12362>.

Format

[R6Class](#) object.

Value

[Param_base](#) object.

Constructor

`define_param(Param_medshift, shift_param, ..., outcome_node)`

observed_likelihood A [Likelihood](#) corresponding to the observed likelihood.

shift_param A numeric, specifying the magnitude of the desired incremental propensity score shift (a multiplier of the odds of receiving treatment).

... Not currently used.

outcome_node A character, giving the name of the node that should be treated as the outcome.

Fields

cf_likelihoold The counterfactual likelihood under the joint stochastic intervention on exposure and mediators.

lf_ipsi Object derived from [LF_base](#) for assessing the joint intervention on exposure and mediators.

treatment_task A [tmle3_Task](#) created by setting the intervention to the treatment condition: do(A = 1).

control_task A [tmle3_Task](#) object created by setting the intervention to the control condition: do(A = 0).

shift_param A numeric, specifying the magnitude of the desired incremental propensity score shift (a multiplier of the odds of receiving treatment).

See Also

Other Parameters: [Param_NDE](#), [Param_NIE](#)

 Param_NDE

Parameter for the natural direct effect

Description

Parameter definition class. See <https://www.ncbi.nlm.nih.gov/pubmed/22499725>

Format

[R6Class](#) object.

Value

Param_base object

Constructor

define_param(Param_NDE, observed_likelihoold, ..., outcome_node)

observed_likelihoold A [Likelihoold](#) corresponding to the observed likelihood.

... Not currently used.

outcome_node A character, giving the name of the node that should be treated as the outcome.

Fields

cf_likelihoold_treatment The counterfactual likelihood for the treatment.

cf_likelihoold_control The counterfactual likelihood for the control.

treatment_task [tmle3_Task](#) created by setting the intervention to the treatment condition: do(A = 1).

control_task [tmle3_Task](#) created by setting the intervention to the control condition: do(A = 0).

See Also

Other Parameters: [Param_NIE](#), [Param_medshift](#)

 Param_NIE

Parameter for the natural indirect effect

Description

Parameter definition class. See <https://www.ncbi.nlm.nih.gov/pubmed/22499725>

Format

R6Class object.

Value

Param_base object

Constructor

`define_param(Param_NIE, observed_likelihood, ..., outcome_node)`

`observed_likelihood` A [Likelihood](#) corresponding to the observed likelihood.

`...` Not currently used.

`outcome_node` A character, giving the name of the node that should be treated as the outcome.

Fields

`cf_likelihood_treatment` The counterfactual likelihood for the treatment.

`cf_likelihood_control` The counterfactual likelihood for the control.

`treatment_task` [tmle3_Task](#) created by setting the intervention to the treatment condition: `do(A = 1)`.

`control_task` [tmle3_Task](#) created by setting the intervention to the control condition: `do(A = 0)`.

See Also

Other Parameters: [Param_NDE](#), [Param_medshift](#)

 tmle3_Spec_medshift

TML Estimator for the Population Intervention (In)direct Effects

Description

TML Estimator for the Population Intervention (In)direct Effects

tmle3_Spec_NDE	<i>TML Estimator for the Natural Direct Effect</i>
----------------	--

Description

TML Estimator for the Natural Direct Effect

tmle3_Spec_NIE	<i>TML Estimator for the Natural Indirect Effect</i>
----------------	--

Description

TML Estimator for the Natural Indirect Effect

tmle_medshift	<i>TML Estimator for the Population Intervention (In)direct Effects</i>
---------------	---

Description

$O = (W, A, Z, Y)$ W = Covariates (possibly multivariate) A = Treatment (binary or categorical) Z = Mediators (binary or categorical; possibly multivariate) Y = Outcome (binary or bounded continuous)

Usage

```
tmle_medshift(
  shift_type = "ipsi",
  delta,
  e_learners,
  phi_learners,
  max_iter = 10000,
  step_size = 1e-06,
  ...
)
```

Arguments

shift_type	A character defining the type of shift to be applied to the exposure – an incremental propensity score intervention.
delta	A numeric, specifying the magnitude of the shift.
e_learners	A Stack (or other learner class that inherits from Lrnr_base), containing a single or set of instantiated learners from sl3 , to be used in fitting a cleverly parameterized propensity score that conditions on the mediators, i.e., $e = P(A Z, W)$.

phi_learners	A Stack (or other learner class that inherits from Lrnr_base), containing a single or set of instantiated learners from sl3 , to be used in a regression of a pseudo-outcome on the baseline covariates, i.e., $\phi(W) = E[m(A = 1, Z, W) - m(A = 0, Z, W) W]$.
max_iter	A numeric setting the maximum iterations allowed in the targeting step based on universal least favorable submodels.
step_size	A numeric giving the step size (delta_epsilon in tmle3) to be used in the targeting step based on universal least favorable submodels.
...	Additional arguments (currently unused).

tmle_NDE	<i>TML Estimator for the Natural Direct Effect</i>
----------	--

Description

O = (W, A, Z, Y) W = Covariates (possibly multivariate) A = Treatment (binary or categorical) Z = Mediators (binary or categorical; possibly multivariate) Y = Outcome (binary or bounded continuous)

Usage

```
tmle_NDE(e_learners, psi_Z_learners, max_iter = 10000, step_size = 1e-06, ...)
```

Arguments

e_learners	A Stack (or other learner class that inherits from Lrnr_base), containing a single or set of instantiated learners from sl3 , to be used in fitting a cleverly parameterized propensity score that conditions on the mediators, i.e., $e = P(A Z, W)$.
psi_Z_learners	A Stack (or other learner class that inherits from Lrnr_base), containing a single or set of instantiated learners from sl3 , to be used in a regression of a pseudo-outcome on the baseline covariates, i.e., $\psi_Z(W) = E[m(A = 1, Z, W) - m(A = 0, Z, W) A = 0, W]$.
max_iter	A numeric setting the maximum iterations allowed in the targeting step based on universal least favorable submodels.
step_size	A numeric giving the step size (delta_epsilon in tmle3) to be used in the targeting step based on universal least favorable submodels.
...	Additional arguments (currently unused).

tmle_NIE

*TML Estimator for the Natural Indirect Effect***Description**

$O = (W, A, Z, Y)$ $W =$ Covariates (possibly multivariate) $A =$ Treatment (binary or categorical) $Z =$ Mediators (binary or categorical; possibly multivariate) $Y =$ Outcome (binary or bounded continuous)

Usage

```
tmle_NIE(e_learners, psi_Z_learners, max_iter = 10000, step_size = 1e-06, ...)
```

Arguments

`e_learners` A [Stack](#) (or other learner class that inherits from [Lrnr_base](#)), containing a single or set of instantiated learners from [sl3](#), to be used in fitting a cleverly parameterized propensity score that conditions on the mediators, i.e., $e = P(A | Z, W)$.

`psi_Z_learners` A [Stack](#) (or other learner class that inherits from [Lrnr_base](#)), containing a single or set of instantiated learners from [sl3](#), to be used in a regression of a pseudo-outcome on the baseline covariates, i.e., $\psi_Z(W) = E[m(A = 1, Z, W) - m(A = 0, Z, W) | A = 0, W]$.

`max_iter` A numeric setting the maximum iterations allowed in the targeting step based on universal least favorable submodels.

`step_size` A numeric giving the step size (delta_epsilon in [tmle3](#)) to be used in the targeting step based on universal least favorable submodels.

`...` Additional arguments (currently unused).

Index

* Likelihood objects

LF_ipsi, 2

* Parameters

Param_medshift, 3

Param_NDE, 4

Param_NIE, 5

* data

LF_ipsi, 2

Param_medshift, 3

Param_NDE, 4

Param_NIE, 5

LF_base, 2, 4

LF_ipsi, 2

Likelihood, 2–5

Lrnr_base, 6–8

Param_base, 3

Param_medshift, 3, 5

Param_NDE, 4, 4, 5

Param_NIE, 4, 5, 5

R6Class, 2–5

Stack, 6–8

tmle3, 7, 8

tmle3_Spec_medshift, 5

tmle3_Spec_NDE, 6

tmle3_Spec_NIE, 6

tmle3_Task, 2–5

tmle_medshift, 6

tmle_NDE, 7

tmle_NIE, 8