Package: tmle3shift (via r-universe)

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Title Targeted Learning of the Causal Effects of Stochastic
Interventions

Version 0.2.2

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Description Targeted maximum likelihood estimation (TMLE) of
population-level causal effects under stochastic treatment
regimes and related nonparametric variable importance analyses.
Tools are provided for TML estimation of the counterfactual
mean under a stochastic intervention characterized as a
modified treatment policy, such as treatment policies that
shift the natural value of the exposure. The causal parameter
and estimation were described in Díaz and van der Laan (2013)
<doi:10.1111/j.1541-0420.2011.01685.x> and an improved
estimation approach was given by Díaz and van der Laan (2018)
<doi:10.1007/978-3-319-65304-4_14>.

Depends R (>= 3.4.0)

License GPL-3

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

Suggests testthat, knitr, rmarkdown, covr, stats, ggplot2, sl3 (>=
1.4.5), txshift (>= 0.3.8), haldensify (>= 0.2.3), hal9001,
xgboost, speedglm, Rsolnp, nnls

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

URL https://tlverse.org/tmle3shift

BugReports https://github.com/tlverse/tmle3shift/issues

Encoding UTF-8

LazyData true

LazyLoad yes

VignetteBuilder knitr

RoxygenNote 7.3.2

Roxygen list(markdown = TRUE, r6 = FALSE)

Contents

LF_shift   *Shifted Likelihood Factor*

Description

Shifts a likelihood factor according to a `shift_function` and a given magnitude of the desired shift (`shift_delta`). In effect, `get_likelihood(tmle_task)` from `tmle3` will instead be the likelihood from the `original_lf`, but for a shifted value $A' =$`shift_function`(A, W).

Format

[`R6Class`](#) object.

Value

LF_base object

Constructor

`define_lf(LF_shift, name, type = "density", original_lf, shift_function, ...)`

`name` character, the name of the factor. Should match a node name in the specification in [`tmle3_Task`](#)`$npsem`.

`original_lf` [`LF_base`](#) object, the likelihood factor to shift.

`shift_function` function, defines the shift.

`shift_inverse` function, the inverse of a given `shift_function`.

shift_delta numeric, specification of the magnitude of the desired shift (on the level of the treatment).

max_shifted_ratio A numeric value indicating the maximum tolerance for the ratio of the counterfactual and observed intervention densities. In particular, the shifted value of the intervention is assigned to a given observational unit when the ratio of the counterfactual intervention density to the observed intervention density is below this value.

... Not currently used.

Fields

original_lf LF_base object, the likelihood factor to shift.

shift_function function, defines the shift.

shift_inverse function, the inverse of a given shift_function.

shift_delta numeric, specification of the magnitude of the desired shift (on the level of the treatment).

max_shifted_ratio A numeric value indicating the maximum tolerance for the ratio of the counterfactual and observed intervention densities. In particular, the shifted value of the intervention is assigned to a given observational unit when the ratio of the counterfactual intervention density to the observed intervention density is below this value.

... Additional arguments passed to the base class.

References

"Stochastic Treatment Regimes." Díaz, Iván and van der Laan, Mark (2018). In Targeted Learning in Data Science: Causal Inference for Complex Longitudinal Studies, 167–80. Springer Science & Business Media.

"Population Intervention Causal Effects Based on Stochastic Interventions." Díaz, Iván and van der Laan, Mark J (2012). Biometrics 68 (2). Wiley Online Library: 541–49.

Param_MSM_linear   *Parameter for Linear Working Marginal Structural Model*

Description

Parameter definition for targeting the parameters of a linear working marginal structural model (MSM): EY = beta0 + beta1 * delta, in order to summarize the variable importance results of a grid of shift interventions.

Format

R6Class object.

Value

Param_base object

Constructor

define_param(Param_MSM_linear, observed_likelihood, intervention_list, ..., outcome_node)

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

intervention_list A list of objects inheriting from [LF_base](#), representing the intervention.

... Not currently used.

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

Fields

cf_likelihood the counterfactual likelihood for this treatment.

intervention_list A list of objects inheriting from [LF_base](#), representing the intervention.

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shift_additive | *Additive Shifts of Continuous-Valued Interventions Without Bounds*

Description

Additive Shifts of Continuous-Valued Interventions Without Bounds

Usage

```
shift_additive(tmle_task, delta = 0, ...)

shift_additive_inv(tmle_task, delta = 0, ...)
```

Arguments

tmle_task	A tmle3_Task object containing data and nodes, as described and implemented in the tmle3 package. Please refer to the documentation and supporting materials of that package for details.
delta	A numeric value giving a value of the shift to be applied to the treatment. This is an additive shift so the value is merely to be added to the observed value of the treatment node "A". In the case of the inverse additive shift, the specified value will be subtracted from the observed value of the treatment node "A".
...	Additional arguments (currently unused).

See Also

Other shifting_interventions: [shift_additive_bounded()](#)

Other shifting_interventions: [shift_additive_bounded()](#)

tmle3_Spec_shift	*Defines a TML Estimator for the Outcome under a Shifted Treatment*

Description

Defines a TML Estimator for the Outcome under a Shifted Treatment

tmle3_Spec_vimshift_delta	
	Defines a TML Estimator for Variable Importance for Continuous Interventions

Description

Defines a TML Estimator for Variable Importance for Continuous Interventions

tmle3_Spec_vimshift_msm	
	Defines a TML Estimator for Variable Importance for Continuous Interventions

Description

Defines a TML Estimator for Variable Importance for Continuous Interventions

tmle_shift	*Outcome under Shifted Treatment*

Description

O = (W, A, Y) W = Covariates A = Treatment (binary or categorical) Y = Outcome (binary or bounded continuous)

Usage

```
tmle_shift(
  shift_fxn = shift_additive,
  shift_fxn_inv = shift_additive_inv,
  shift_val = 1,
  max_shifted_ratio = 5,
  ...
)
```

Arguments

`shift_fxn`	A `function` defining the type of shift to be applied to the treatment. For a simple example, see `shift_additive`.
`shift_fxn_inv`	A `function` defining the inverse of the type of shift to be applied to the treatment. For a simple example, see `shift_additive_inv`.
`shift_val`	A `numeric`, specification of the magnitude of the desired shift (on the level of the treatment). This is a value passed to the `functions` above for modulating the treatment.
`max_shifted_ratio`	
	A `numeric` value indicating the maximum tolerance for the ratio of the counterfactual and observed intervention densities. In particular, the shifted value of the intervention is assigned to a given observational unit when the ratio of counterfactual intervention density to the observed intervention density is below this value.
`...`	Additional arguments (currently unused).

`tmle_vimshift_delta`	*Outcome Under a Grid of Shifted Interventions via Delta Method*

Description

O = (W, A, Y) W = Covariates A = Treatment (binary or categorical) Y = Outcome (binary or bounded continuous)

Usage

```
tmle_vimshift_delta(
  shift_fxn = shift_additive,
  shift_fxn_inv = shift_additive_inv,
  shift_grid = seq(-1, 1, by = 0.5),
  max_shifted_ratio = 5,
  weighting = c("identity", "variance"),
  ...
)
```

Arguments

`shift_fxn`	A `function` defining the type of shift to be applied to the treatment. For an example, see `shift_additive`.
`shift_fxn_inv`	A `function` defining the inverse of the type of shift to be applied to the treatment. For an example, see `shift_additive_inv`.
`shift_grid`	A `numeric` vector, specification of a selection of shifts (on the level of the treatment) to be applied to the intervention. This is a value passed to the `functions` above for computing various values of the outcome under modulated values of the treatment.

max_shifted_ratio

> A numeric value indicating the maximum tolerance for the ratio of the coun-
> terfactual and observed intervention densities. In particular, the shifted value of
> the intervention is assigned to a given observational unit when the ratio of coun-
> terfactual intervention density to the observed intervention density is below this
> value.

weighting   A character indicating the type of weighting used for construction of the
> marginal structural model. "identity" applies the same weight to all individ-
> ual estimates while "variance" applies weights based on the inverse variance
> of the estimate. It would be expected that variance-based weighting would yield
> more stable estimates of the parameter of the MSM. The default remains the
> identity weighting.

...   Additional arguments, passed to shift functions.

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tmle_vimshift_msm   *Outcome Under a Grid of Shifted Interventions via Targeted Working MSM*

Description

O = (W, A, Y) W = Covariates A = Treatment (binary or categorical) Y = Outcome (binary or
bounded continuous)

Usage

```
tmle_vimshift_msm(
  shift_fxn = shift_additive,
  shift_fxn_inv = shift_additive_inv,
  shift_grid = seq(-1, 1, by = 0.5),
  max_shifted_ratio = 5,
  weighting = c("identity", "variance"),
  ...
)
```

Arguments

shift_fxn   A function defining the type of shift to be applied to the treatment. For an
> example, see shift_additive.

shift_fxn_inv   A function defining the inverse of the type of shift to be applied to the treat-
> ment. For an example, see shift_additive_inv.

shift_grid   A numeric vector, specification of a selection of shifts (on the level of the treat-
> ment) to be applied to the intervention. This is a value passed to the functions
> above for computing various values of the outcome under modulated values of
> the treatment.

max_shifted_ratio

> A numeric value indicating the maximum tolerance for the ratio of the counterfactual and observed intervention densities. In particular, the shifted value of the intervention is assigned to a given observational unit when the ratio of counterfactual intervention density to the observed intervention density is below this value.

weighting

> A character indicating the type of weighting used for construction of the marginal structural model. "identity" applies the same weight to all individual estimates while "variance" applies weights based on the inverse variance of the estimate. It would be expected that variance-based weighting would yield more stable estimates of the parameter of the MSM. The default remains the identity weighting.

...

> Additional arguments, passed to shift functions.

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trend_msm   *Test for a trend in the effect of shift interventions via working MSM*

Description

Test for a trend in the effect of shift interventions via working MSM

Usage

```
trend_msm(
  tmle_fit_estimates,
  delta_grid,
  level = 0.95,
  weighting = c("identity", "variance")
)
```

Arguments

tmle_fit_estimates

> A list corresponding to the $estimates slot of an object of class tmle3_Fit, containing estimates of a grid of posited shift interventions.

delta_grid

> A numeric vector giving the individual values of the shift parameter used in computing each of the TML estimates.

level

> The nominal coverage probability of the confidence interval.

weighting

> A character indicating the type of weighting used for construction of the marginal structural model. "identity" applies the same weight to all individual estimates while "variance" applies weights based on the inverse variance of the estimate. It would be expected that variance-based weighting would yield more stable estimates of the parameter of the MSM. The default is identity-based weighting.

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