Package ‘desla’
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Type Package

Title Desparsified Lasso Inference for Time Series

Version 0.3.0

Description Calculates the desparsified lasso as originally introduced in van de Geer et al. (2014) <doi:10.1214/14-AOS1221>, and provides inference suitable for high-dimensional time series, based on the long run covariance estimator in Adamek et al. (2020) <arXiv:2007.10952>. Also estimates high-dimensional local projections by the desparsified lasso, as described in Adamek et al. (2022) <arXiv:2209.03218>.

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Imports Rcpp, Rdpack, stats, parallelly

URL https://github.com/RobertAdamek/desla

BugReports https://github.com/RobertAdamek/desla/issues

Suggests ggplot2

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Author Robert Adamek [cre, aut],
Stephan Smeekes [aut],
Ines Wilms [aut]

Maintainer Robert Adamek <robertadamek94@gmail.com>

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create_state_dummies  Create State Dummies

Description

Creates state dummies for use in HDLP.

Usage

create_state_dummies(x)

Arguments

x  Contains the variables that define the states. Each column should either represent a categorical variable indicating the state of each observation, or each column should be a binary indicator for one particular state.

Details

The function first checks if x is already in the correct output format by evaluating if each row sums up to one. If this is not the case, each column is treated as a categorical variable for which its unique entries define the states it can take. If x contains more than one column, interactions between the variables are created. Example, inputting two variables that can take two states each, results in a total of four possible states, and hence the output matrix contains four columns.

Value

A matrix where each column is a binary indicator for one state.

desla  Desparsified lasso

Description

Calculates the desparsified lasso as originally introduced in van de Geer et al. (2014), and provides inference suitable for high-dimensional time series, based on the long run covariance estimator in Adamek et al. (2021).
Usage

```
    desla(
        X,
        y,
        H,
        alphas = 0.05,
        penalize_H = TRUE,
        R = NULL,
        q = NULL,
        demean = TRUE,
        scale = TRUE,
        progress_bar = TRUE,
        parallel = TRUE,
        threads = NULL,
        PI_constant = NULL,
        LRV_bandwidth = NULL
    )
```

Arguments

- **X** : T_ x N regressor matrix
- **y** : T_ x 1 dependent variable vector
- **H** : indexes of relevant regressors
- **alphas** : (optional) vector of significance levels (0.05 by default)
- **penalize_H** : (optional) boolean, true if you want the variables in H to be penalized (TRUE by default)
- **R** : (optional) matrix with number of columns the dimension of H, used to test the null hypothesis R*beta=q (identity matrix as default)
- **q** : (optional) vector of size same as the rows of H, used to test the null hypothesis R*beta=q (zeroes by default)
- **demean** : (optional) boolean, true if X and y should be demeaned before the desparsified lasso is calculated. This is recommended, due to the assumptions for the method (true by default)
- **scale** : (optional) boolean, true if X and y should be scaled by the column-wise standard deviations. Recommended for lasso based methods in general, since the penalty is scale-sensitive (true by default)
- **progress_bar** : (optional) boolean, displays a progress bar while running if true, tracking the progress of estimating the nodewise regressions (TRUE by default)
- **parallel** : boolean, whether parallel computing should be used (TRUE by default)
- **threads** : (optional) integer, how many threads should be used for parallel computing if parallel=TRUE (default is to use all but two)
- **PI_constant** : (optional) constant, used in the plug-in selection method (0.8 by default). For details see Adamek et al. (2021)
LRV_bandwidth  (optional) vector of parameters controlling the bandwidth \( Q_T \) used in the long run covariance matrix, \( Q_T = \text{ceil}(LRV\_bandwidth[1] \times T \times LRV\_bandwidth[2]) \). When \( LRV\_bandwidth = \text{NULL} \), the bandwidth is selected according to Andrews (1991) (default).

Value

Returns a list with the following elements:

- **bhat**: desparsified lasso estimates for the parameters indexed by \( H \), unscaled to be in the original scale of \( y \) and \( X \)
- **standard_errors**: standard errors of the estimates for variables indexed by \( H \)
- **intervals**: matrix containing the confidence intervals for parameters indexed in \( H \), unscaled to be in the original scale of \( y \) and \( X \)
- **betahat**: lasso estimates from the initial regression of \( y \) on \( X \)
- **DSL_matrices**: list containing the matrices \( \Gammahat, \Upsilonhat\_inv \) and \( \Thetahat \) used for calculating the desparsified lasso, as well as \( \Omegahat \), the long run covariance matrix for the variables indexed by \( H \). For details see Adamek et al. (2021)
- **residuals**: list containing the vector of residuals from the initial lasso regression (init) and the matrix of residuals from the nodewise regressions (nw)
- **lambdas**: values of lambda selected in the initial lasso regression (init) and the nodewise lasso regressions (nw)
- **selected_vars**: vector of indexes of the nonzero parameters in the initial lasso (init) and each nodewise regression (nw)
- **wald_test**: list containing elements for inference on \( R \beta = q \). **joint_test** contains the test statistic for the overall null hypothesis \( R \beta = q \) along with the p-value. At default values of \( R \) and \( q \), this tests the joint significance of all variables indexed by \( H \). \( \text{row}\_\text{tests} \) contains the vector of z-statistics and confidence intervals associated with each row of \( R \beta - q \), unscaled to be in the original scale of \( y \) and \( X \). This output is only given when either \( R \) or \( q \) are supplied.

References


**Examples**

\[
X<-\text{matrix}(\text{rnorm}(50*50), \text{nrow}=50) \\
y<-X[,1:4] \times c(1, 2, 3, 4) + \text{rnorm}(50) \\
H<-c(1, 2, 3, 4) \\
d<-\text{desla}(X, y, H)
\]

**Description**

Calculates impulse responses with local projections, using the desla function to estimate the high-dimensional linear models, and provide asymptotic inference. The naming conventions in this function follow the notation in Plagborg-Moller and Wolf (2021), in particular Equation 1 therein. This function also allows for estimating state-dependent responses, as in Ramey and Zubairy (2018).

**Usage**

```r
HDLP(
  x, 
  y, 
  r = NULL, 
  q = NULL, 
  state_variables = NULL, 
  y_predetermined = FALSE, 
  cumulate_y = FALSE, 
  hmax = 24, 
  lags = 12, 
  alphas = 0.05, 
  penalize_x = FALSE, 
  PI_constant = NULL, 
  progress_bar = TRUE, 
  OLS = FALSE, 
  parallel = TRUE, 
  threads = NULL
)
```

**Arguments**

- **x**
  - T_x1 vector containing the shock variable, see Plagborg-Moller and Wolf (2021) for details

- **y**
  - T_x1 vector containing the response variable, see Plagborg-Moller and Wolf (2021) for details

- **r**
  - (optional) vector or matrix with T_rows, containing the "slow" variables, ones which do not react within the same period to a shock, see Plagborg-Moller and Wolf (2021) for details(NULL by default)
(optional) vector or matrix with \( T \) rows, containing the "fast" variables, ones which may react within the same period to a shock, see Plagborg-Moller and Wolf (2021) for details (NULL by default)

\textbf{state_variables}

(optional) matrix or data frame with \( T \) rows, containing the variables that define the states. Each column should either represent a categorical variable indicating the state of each observation, or each column should be a binary indicator for one particular state; see 'Details'.

\textbf{y_predetermined}

(optional) boolean, true if the response variable \( y \) is predetermined with respect to \( x \), i.e. cannot react within the same period to the shock. If true, the impulse response at horizon 0 is 0 (false by default)

\textbf{cumulate_y}

(optional) boolean, true if the impulse response of \( y \) should be cumulated, i.e. using the cumulative sum of \( y \) as the dependent variable (false by default)

\textbf{hmax}

(optional) integer, the maximum horizon up to which the impulse responses are computed. Should not exceed the \( T - lags \) (24 by default)

\textbf{lags}

(optional) integer, the number of lags to be included in the local projection model. Should not exceed \( T - hmax \) (12 by default)

\textbf{alphas}

(optional) vector of significance levels (0.05 by default)

\textbf{penalize_x}

(optional) boolean, true if the parameter of interest should be penalized (FALSE by default)

\textbf{PI_constant}

(optional) constant, used in the plug-in selection method (0.8 by default). For details see Adamek et al. (2021)

\textbf{progress_bar}

(optional) boolean, true if a progress bar should be displayed during execution (true by default)

\textbf{OLS}

(optional) boolean, whether the local projections should be computed by OLS instead of the desparsified lasso. This should only be done for low-dimensional regressions (FALSE by default)

\textbf{parallel}

boolean, whether parallel computing should be used. Default is TRUE.

\textbf{threads}

(optional) integer, how many threads should be used for parallel computing if parallel=TRUE. Default is to use all but two.

\textbf{Details}

The input to \texttt{state_variables} is transformed to a suitable matrix where each column represents one state using the function \texttt{create_state_dummies}. See that function for further details.

\textbf{Value}

Returns a list with the following elements:

\textbf{intervals}

list of matrices containing the point estimates and confidence intervals for the impulse response functions in each state, for significance levels given in \texttt{alphas}

\textbf{Thetahat}

matrix (row vector) calculated from the nodewise regression at horizon 0, which is re-used at later horizons

\textbf{betahats}

list of matrices (column vectors), giving the initial lasso estimate at each horizon
plot.hdlp

References


Examples

```r
X <- matrix(rnorm(50*50), nrow=50)
y <- X[,1:4] %*% c(1,2,3,4) + rnorm(50)
s <- matrix(c(rep(1,25), rep(0,50), rep(1,25)), ncol=2, dimnames = list(NULL, c("A","B")))
h <- HDLP(x=X[,4], y=y, q=X[,-4], state_variables=s, hmax=5, lags=1)
plot(h)
```

---

**Description**

Plot Impulse Responses obtained from HDLP.

**Usage**

```r
## S3 method for class 'hdlp'
plot(
  x,
  y = NULL,
  response = NULL,
  impulse = NULL,
  states = NULL,
  units = NULL,
  title = NULL,
  ...
)
```

**Arguments**

- `x` Output of the `HDLP()` function.
- `y` Has no function, included for compatibility with `plot.default()`.
- `response` Name of the response variable (y in `HDLP()`).
- `impulse` Name of the shock variable (x in `HDLP()`).
plot.hdln

states: Optional names of the states (when applicable). If not provided, names will be determined from x.
units: Units of the response variable (y-axis label).
title: String containing title of the plot; can be used to overwrite default generated based on the names of the response and impulse variables.
... Other arguments forwarded to plot function (currently inactive).

Value

A ggplot object.
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