Package ‘vinereg’

May 14, 2021

Type Package
Title D-Vine Quantile Regression
Version 0.7.4
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Description Implements D-vine quantile regression models with
parametric or nonparametric pair-copulas. See
Kraus and Czado (2017) <doi:10.1016/j.csda.2016.12.009> and
License GPL-3
Imports rvinecopulib (>= 0.5.4.1.0), kde1d (>= 1.0.2), Rcpp,
assertthat
LinkingTo rvinecopulib, RcppEigen, Rcpp, BH, wdm, RcppThread, kde1d
RoxygenNote 7.1.1
NeedsCompilation yes
Suggests knitr, rmarkdown, ggplot2, AppliedPredictiveModeling,
quantreg, tidyr, dplyr, purrr, scales, mgcv, testthat, covr
VignetteBuilder knitr
URL https://tnagler.github.io/vinereg/
BugReports https://github.com/tnagler/vinereg/issues
Encoding UTF-8
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Repository CRAN
Date/Publication 2021-05-14 18:40:03 UTC

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cpit

Conditional probability integral transform

Description
Calculates the conditional distribution of the response given the covariates.

Usage

```r
cpit(object, newdata, cores = 1)
```

Arguments

- `object`: an object of class `vinereg`.
- `newdata`: matrix of response and covariate values for which to compute the conditional distribution.
- `cores`: integer; the number of cores to use for computations.

Examples

```r
# simulate data
x <- matrix(rnorm(500), 250, 2)
y <- x %*% c(1, -2)
dat <- data.frame(y = y, x = x, z = as.factor(rbinom(250, 2, 0.5)))

# fit vine regression model
fit <- vinereg(y ~ ., dat)
hist(cpit(fit, dat)) # should be approximately uniform
```

plot_effects

Plot marginal effects of a D-vine regression model

Description
The marginal effects of a variable is the expected effect, where expectation is meant with respect to all other variables.

Usage

```r
plot_effects(object, alpha = c(0.1, 0.5, 0.9), vars = object$order)
```
predict.vinereg

Arguments

object  a vinereg object
alpha   vector of quantile levels.
vars    vector of variable names.

Examples

# simulate data
x <- matrix(rnorm(200), 100, 2)
y <- x %*% c(1, -2)
dat <- data.frame(y = y, x = x, z = as.factor(rbinom(100, 2, 0.5)))

# fit vine regression model
fit <- vinereg(y ~ ., dat)
plot_effects(fit)

predict.vinereg  Predict conditional mean and quantiles from a D-vine regression model

Description

Predict conditional mean and quantiles from a D-vine regression model

Usage

## S3 method for class 'vinereg'
predict(object, newdata, alpha = 0.5, cores = 1, ...)

## S3 method for class 'vinereg'
fitted(object, alpha = 0.5, ...)

Arguments

object  an object of class vinereg.
newdata matrix of covariate values for which to predict the quantile.
alpha   vector of quantile levels; NA predicts the mean based on an average of the 1:10 / 11-quantiles.
cores   integer; the number of cores to use for computations.
...     unused.

Value

A data.frame of quantiles where each column corresponds to one value of alpha.
Examples

# simulate data
x <- matrix(rnorm(200), 100, 2)
y <- x %*% c(1, -2)
dat <- data.frame(y = y, x = x, z = as.factor(rbinom(100, 2, 0.5)))

# fit vine regression model
(fit <- vinereg(y ~ ., dat))

# inspect model
summary(fit)
plot_effects(fit)

# model predictions
mu_hat <- predict(fit, newdata = dat, alpha = NA) # mean
med_hat <- predict(fit, newdata = dat, alpha = 0.5) # median

# observed vs predicted
plot(cbind(y, mu_hat))

## fixed variable order (no selection)
(fit <- vinereg(y ~ ., dat, order = c("x.2", "x.1", "z.1")))

---

vinereg

D-vine regression models

Description

Sequential estimation of a regression D-vine for the purpose of quantile prediction as described in Kraus and Czado (2017).

Usage

vinereg(
  formula,
  data,
  family_set = "parametric",
  selcrit = "aic",
  order = NA,
  par_1d = list(),
  weights = numeric(),
  cores = 1,
  ...
)
Arguments

- **formula**: an object of class "formula"; same as `lm()`.  
- **data**: data frame (or object coercible by `as.data.frame()`) containing the variables in the model.  
- **family_set**: see family_set argument of `rvinecopulib::bicop()`.  
- **selcrit**: selection criterion based on conditional log-likelihood. "loglik" (default) imposes no correction; other choices are "aic" and "bic".  
- **order**: the order of covariates in the D-vine, provided as vector of variable names (after calling `vinereg:::expand_factors(model.frame(formula,data)))`; selected automatically if order = NA (default).  
- **par_1d**: list of options passed to `kde1d::kde1d()`, must be one value for each margin, e.g. `list(xmin = c(0,0,NaN))` if the response and first covariate have non-negative support.  
- **weights**: optional vector of weights for each observation.  
- **cores**: integer; the number of cores to use for computations.  
- **...**: further arguments passed to `rvinecopulib::bicop()`.

Details

If discrete variables are declared as `ordered()` or `factor()`, they are handled as described in Panagiotelis et al. (2012). This is different from previous version where the data was jittered before fitting.

Value

An object of class `vinereg`. It is a list containing the elements

- **formula**: the formula used for the fit.  
- **selcrit**: criterion used for variable selection.  
- **model_frame**: the data used to fit the regression model.  
- **margins**: list of marginal models fitted by `kde1d::kde1d()`.  
- **vine**: an `rvinecopulib::vinecop_dist()` object containing the fitted D-vine.  
- **stats**: fit statistics such as conditional log-likelihood/AIC/BIC and p-values for each variable’s contribution.  
- **order**: order of the covariates chosen by the variable selection algorithm.  
- **selected_vars**: indices of selected variables.  

Use `predict.vinereg()` to predict conditional quantiles. `summary.vinereg()` shows the contribution of each selected variable with the associated p-value derived from a likelihood ratio test.

References

Kraus and Czado (2017), D-vine copula based quantile regression, Computational Statistics and Data Analysis, 110, 1-18

See Also

predict.vinereg

Examples

# simulate data
x <- matrix(rnorm(200), 100, 2)
y <- x %*% c(1, -2)
dat <- data.frame(y = y, x = x, z = as.factor(rbinom(100, 2, 0.5)))

# fit vine regression model
(fit <- vinereg(y ~ ., dat))

# inspect model
summary(fit)
plot_effects(fit)

# model predictions
mu_hat <- predict(fit, newdata = dat, alpha = NA) # mean
med_hat <- predict(fit, newdata = dat, alpha = 0.5) # median

# observed vs predicted
plot(cbind(y, mu_hat))

## fixed variable order (no selection)
(fit <- vinereg(y ~ ., dat, order = c("x.2", "x.1", "z.1")))
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