Package ‘ORDER2PARENT’

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Type Package

Title Estimate parent distributions with data of several order statistics

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Depends splines, Matrix

Description This package uses B-spline based nonparametric smooth estimators to estimate parent distributions given observations on multiple order statistics.

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ORDER2PARENT-package  Parent Distribution Estimation with Multiple Order Statistics

Description

This package can estimate parent distribution nonparametrically when there are observations about multiple order statistics available. The estimator is based on B-spline.

Details

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bgmm, blr, parentest

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bgmm  Parent Distribution Estimation with B-Spline GMM Estimator

Description

Given observations on several order statistics, this function use the B-Spline GMM Estimator (Chou and Tao, 2010) to estimate the corresponding parent distribution of these order statistics nonparametrically.

Usage

bgmm(dat, orderinfo, degree = 3, support = NULL, weight.type = 1)

Arguments

dat      a list consisting of the vectors of observations on various order statistics.
orderinfo a matrix about the ranks and the sizes of various order statistics.
degree   the degree of B-spline used for estimation. The default is 3, i.e. cubic B-spline.
support

a vector specifying the support of the parent distribution. If unknown, it can be omitted, and the interval of data will be used as the support.

weight.type

the type of weight matrix used in implementing the GMM estimator. The default is 1, i.e. the weight matrix based on sample size.

Details

The data must be a list consisting of vectors of observations on order statistics. For example, there are three order statistics, and the observations on them are contained in three vectors, dat.order1, dat.order2, and dat.order3. Then atypical data is list(dat.order1, dat.order2, dat.order3).

orderinfo must be a matrix with two columns and J rows where J is the number of observed order statistics. For j-th row of orderinfo, the first column is the rank, and the second column is the size of the j-th order statistic. \support is vector whose first element is the lower bound of the support, and the second element is the upper bound. If you want to use the second type of weight matrix, which is based on mean square error of the first stage estimates, set weight.type=2.

Value

bgmm gives a list consisting of two elements: betahat and n.knots. These two elements will be used in parentest for estimation of parent cdf.

See Also

blr, parentest

Examples

n.order<-c(20, 20, 60) # number of observations for each order statistic below.
m<-5 # the size of random samples is 5.
# The three order statistics are 1:5 (the minimum), 3:5 (the sample median),
# and 5:5 (the maximum)
rank.x<-c(1, 3, 5)
data.example<-list()
for(i in 1:3){
  sorted.sample<-t(apply(matrix(rnorm(m*n.order[i]),nr=n.order[i],nc=m), 1, sort))
data.example[i]<-sorted.sample[,rank.x[i]]
}
order.example<-rbind(c(1, 5), c(3, 5), c(5, 5), deparse.level=0)
gmm.example<-bgmm(data.example, order.example)
Usage

blr(dat, orderinfo, degree = 3, support = NULL, constraint = FALSE)

Arguments

dat a list consisting of the vectors of observations on various order statistics.
datinfo a matrix about the ranks and the sizes of various order statistics.
degree the degree of B-spline used for estimation. The default is 3, i.e. cubic B-spline.
support a vector specifying the support of the parent distribution. If unknown, it can be omitted, and the interval of data will be used as the support.
constraint whether add monotone constraints in estimation. The default is no (FALSE).

Details

The details about specifying the above arguments can be found in bgmm.

Value

blr gives a list consisting of two element: betahat and n.knots. These two elements will be used in parentest for estimation of parent cdf.

See Also

bgmm, parentest

Examples

n.order<-c(20, 20, 60) # number of observations for each order statistic below.
m<-5 # the size of random samples is 5.
# The three order statistics are 1:5 (the minimum), 3:5 (the sample median), # and 5:5 (the maximum)
rank.x<-c(1, 3, 5)
data.example<-list()
for(i in 1:3){
  sorted.sample<-t(apply(matrix(rnorm(m*n.order[i]),nr=n.order[i],nc=m), 1, sort))
data.example[i]<-sorted.sample[,rank.x[i]]
}
order.example<-rbind(c(1, 5), c(3, 5), c(5, 5), deparse.level=0)
blr.example<-blr(data.example, order.example)
\textit{parentcdf} \hspace{1.2cm} \textit{Transform CDF of Order Statistics to Its Parent CDF}

\textbf{Description}

Using the well relationship between the cdf of order statistic and the cdf of parent distribution, this function can transform the cdf of order statistic to the corresponding parent cdf.

\textbf{Usage}

\begin{verbatim}
parentcdf(F.order, k, m)
\end{verbatim}

\textbf{Arguments}

\begin{itemize}
  \item \texttt{F.order} \hspace{1cm} CDF of order statistic, either a scalar or a vector.
  \item \texttt{k} \hspace{1cm} the rank of the order statistic
  \item \texttt{m} \hspace{1cm} the size of the order statistic
\end{itemize}

\textbf{Details}

Use the well known relationship (David and Nagaraja, 2003) between the cdf of order statistic and the parent distribution, \texttt{parentcdf} will return the corresponding parent distribution.

\textbf{Value}

The corresponding parent distribution.

\textbf{References}


\textit{parentest} \hspace{1.2cm} \textit{Generate Smooth Estimator of Parent Distribution}

\textbf{Description}

Using the output from \texttt{b1r} or \texttt{bgmm}, this function gives rise to estimates of parent cdf for any given value.

\textbf{Usage}

\begin{verbatim}
parentest(x, beta.hat, n.knots, degree = 3, support = NULL)
\end{verbatim}
Arguments

- **x0**: the value whose parent cdf’s are wanted. It can either be a scalar or a vector.
- **beta.hat**: the estimate of control variables.
- **n.knots**: the number of inner knots.
- **degree**: the degree of B-spline. The default is 3, i.e. a cubic B-spline.
- **support**: a vector specifying the support of the parent distribution. If unknown, it can be omitted, and the interval of data will be used as the support.

Details

Together with blr and/or bgmm, this function can be estimate the parent cdf of any given value.

Value

The estimates of parent cdf’s of x0. NOTE that the degree used in parentest should be consistent with the degree used in estimation of control variables.

See Also

blr, bgmm

Examples

```r
n.order<-c(20, 20, 60) # number of observations for each order statistic below.
m<-5 # the size of random samples is 5.
# The three order statistics are 1:5 (the minimum), 3:5 (the sample median),
# and 5:5 (the maximum)
rank.x<-c(1, 3, 5)
data.example<-list()
for(i in 1:3){
  sorted.sample<-t(apply(matrix(rnorm(m*n.order[i]),nr=n.order[i],nc=m), 1, sort))
data.example[[i]]<-sorted.sample[,rank.x[i]]
}
order.example<-rbind(c(1, 5), c(3, 5), c(5, 5), rep(0, 5))
blr.example<-blr(data.example, order.example)
# Based on 'blr.example', we can estimate the parent cdf of given values, like data.example[[3]]
parenthat<-parentest(data.example[[3]], blr.example$betahat, blr.example$n.knots)
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