

# Package ‘forestError’

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**Type** Package  
**Title** A Unified Framework for Random Forest Prediction Error Estimation  
**Version** 0.0.0.9000  
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**Description** Estimates the conditional error distributions of random forest predictions and common parameters of those distributions, including conditional mean squared prediction errors, conditional biases, and conditional quantiles. This package is compatible with several of the existing packages that implement random forests in R.  
**Imports** Rcpp,  
foreach,  
doParallel  
**License** GPL-3  
**Encoding** UTF-8  
**LazyData** true  
**RoxygenNote** 6.1.1  
**LinkingTo** Rcpp

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perror	<i>Estimated conditional prediction error CDFs</i>
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### Description

Returns probabilities from the estimated conditional cumulative distribution function of the prediction error associated with each test observation.

**Usage**

```
perror(q, xs)
```

**Arguments**

**q** A vector of quantiles.

**xs** A vector of the indices of the test observations for which the conditional error CDFs are desired. Defaults to all test observations given in the call of `quantForestError`.

**Value**

If either `q` or `xs` has length one, then a vector is returned with the desired probabilities. If both have length greater than one, then a `data.frame` of probabilities is returned, with rows corresponding to the inputted `xs` and columns corresponding to the inputted `q`.

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**See Also**

[quantForestError](#)

**Examples**

```
# get the probability that the error associated with each test
# prediction is less than -4 and the probability that the error
# associated with each test prediction is less than 7
pererror(c(-4, 7))

# same as above but only for the first three test observations
pererror(c(-4, 7), 1:3)
```

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qerror

*Estimated conditional prediction error quantile functions*

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**Description**

Returns quantiles of the estimated conditional error distribution associated with each test prediction.

**Usage**

```
qerror(p, xs)
```

**Arguments**

**p** A vector of probabilities.

**xs** A vector of the indices of the test observations for which the conditional error quantiles are desired. Defaults to all test observations given in the call of `quantForestError`.

**Value**

If either `p` or `xs` has length one, then a vector is returned with the desired quantiles. If both have length greater than one, then a `data.frame` of quantiles is returned, with rows corresponding to the inputted `xs` and columns corresponding to the inputted `p`.

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**See Also**

[quantForestError](#)

**Examples**

```
# get the 0.25 and 0.8 quantiles of the error distribution
# associated with each test observation
qerror(c(0.25, 0.8))

# same as above but only for the first three test observations
qerror(c(0.25, 0.8), 1:3)
```

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quantForestError	<i>Quantify random forest prediction error</i>
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**Description**

Estimates the conditional mean squared prediction errors, conditional biases, conditional prediction intervals, and conditional error distributions of random forest predictions.

**Usage**

```
quantForestError(forest, X.train, X.test, Y.train = NULL,
  what = c("mspe", "bias", "interval", "p.error", "q.error"),
  alpha = 0.05, n.cores = 1)
```

**Arguments**

<code>forest</code>	The random forest object being used for prediction.
<code>X.train</code>	A matrix or <code>data.frame</code> with the observations that were used to train forest; each row should be an observation, and each column should be a predictor variable.
<code>X.test</code>	A matrix or <code>data.frame</code> with the observations to be predicted; each row should be an observation, and each column should be a predictor variable.
<code>Y.train</code>	A vector of the responses of the observations that were used to train forest. Required if forest was created using <code>ranger</code> , but not if forest was created using <code>randomForest</code> , <code>randomForestSRC</code> , or <code>quantregForest</code> .

what	A vector of characters indicating what outputs are desired. Possible options are conditional mean squared prediction error estimates ("mspe"), conditional bias estimates ("bias"), conditional prediction intervals ("interval"), the conditional error distribution functions ("p.error"), and the conditional quantile functions ("q.error").
alpha	The type-I error rate desired for the conditional prediction intervals; required if "interval" is included in what.
n.cores	Number of cores to use (for parallel computation).

### Details

When training the random forest using `randomForest`, `ranger`, or `quantregForest`, `keep.inbag` must be set to `TRUE`. When training the random forest using `randomForestSRC`, `membership` must be set to `TRUE`.

The computation can be parallelized by setting the value of `n.cores` to be greater than 1.

The random forest predictions are always returned as a `data.frame`. Additional columns are included in the `data.frame` depending on the user's selections in the argument `what`. In particular, including "mspe" in `what` will add an additional column with the conditional mean squared prediction error of each test prediction to the `data.frame`; including "bias" in `what` will add an additional column with the conditional bias of each test prediction to the `data.frame`; and including "interval" in `what` will add to the `data.frame` two additional columns with the lower and upper bounds of a conditional prediction interval for each test prediction.

If "p.error" or "q.error" is included in `what`, then a list will be returned as output. The first element of the list, named "estimates", is the `data.frame` described in the above paragraph. The other one or two elements of the list are the estimated CDFs (`perror`) and/or the estimated quantile functions (`qerror`) of the conditional error distributions associated with the test predictions.

### Value

A `data.frame` with one or more of the following columns, as described in the details section:

pred	The random forest predictions of the test observations
mspe	The estimated conditional mean square prediction errors of the random forest predictions
bias	The estimated conditional biases of the random forest predictions
lower	The estimated lower bounds of the conditional prediction intervals for the test observations
upper	The estimated upper bounds of the conditional prediction intervals for the test observations

In addition, one or both of the following functions, as described in the details section:

perror	The estimated cumulative distribution functions of the conditional error distributions associated with the test predictions
qerror	The estimated quantile functions of the conditional error distributions associated with the test predictions

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