Package ‘struct’

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Type Package
Title Statistics in R Using Class-based Templates
Version 1.14.1
Description Defines and includes a set of class-based templates for developing and implementing data processing and analysis workflows, with a strong emphasis on statistics and machine learning. The templates can be used and where needed extended to ‘wrap’ tools and methods from other packages into a common standardised structure to allow for effective and fast integration. Model objects can be combined into sequences, and sequences nested in iterators using overloaded operators to simplify and improve readability of the code. Ontology lookup has been integrated and implemented to provide standardised definitions for methods, inputs and outputs wrapped using the class-based templates.
License GPL-3
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Collate 'generics.R' 'ontology_term_class.R' 'struct_class.R'
   'parameter_class.R' 'chart_class.R' 'stato_class.R'
'DatasetExperiment_class.R' 'entity_class.R'
   'entity_stato_class.R' 'enum_class.R' 'enum_stato_class.R'
'output_class.R' 'model_class.R' 'example_objects.R'
   'model_list_class.R' 'metric_class.R' 'iterator_class.R'
'optimiser_class.R' 'preprocess_class.R' 'resampler_class.R'
   'struct.R' 'struct_templates.R'

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R topics documented:

.DollarNames.struct_class ........................................ 3
as.code ............................................................. 5
as.DatasetExperiment ................................................. 6
as.DatasetExperiment,SummarizedExperiment-method .................. 7
as.SummarizedExperiment ............................................. 7
as.SummarizedExperiment,DatasetExperiment-method .................. 8
as_data_frame ........................................................ 8
c,ontology_list-method ............................................. 9
calculate ............................................................. 9
chart ................................................................. 10
chart_names .......................................................... 11
chart_plot ............................................................ 12
 citations ............................................................. 13
DatasetExperiment ..................................................... 13
entity_stato .......................................................... 15
enum ................................................................. 16
enum_stato ........................................................... 17
example_chart ........................................................ 18
example_iterator-class ............................................. 19
example_model ......................................................... 19
export_xlsx ........................................................... 20
iris_DatasetExperiment ............................................... 21
is_output ............................................................ 22
is_param ............................................................... 22
libraries ............................................................... 23
max_length ............................................................ 24
model ................................................................. 25
models ................................................................. 28
model_apply .......................................................... 28
model_predict ........................................................ 29
model_reverse ........................................................ 29
model_seq ............................................................. 30
model_train .......................................................... 32
new_struct ............................................................ 33
ontology ............................................................... 34
This function returns slotnames for autocompletion when using $ syntax
Usage

```r
## S3 method for class 'struct_class'
.DollarNames(x, pattern = "")

## S4 method for signature 'struct_class'
.DollarNames(x, pattern = "")

## S3 method for class 'chart'
.DollarNames(x, pattern = "")

## S4 method for signature 'chart'
.DollarNames(x, pattern = "")

## S3 method for class 'DatasetExperiment'
.DollarNames(x, pattern = "")

## S4 method for signature 'DatasetExperiment'
.DollarNames(x, pattern = "")

## S3 method for class 'model'
.DollarNames(x, pattern = "")

## S4 method for signature 'model'
.DollarNames(x, pattern = "")

## S3 method for class 'metric'
.DollarNames(x, pattern = "")

## S4 method for signature 'metric'
.DollarNames(x, pattern = "")

## S3 method for class 'iterator'
.DollarNames(x, pattern = "")

## S4 method for signature 'iterator'
.DollarNames(x, pattern = "")

## S3 method for class 'optimiser'
.DollarNames(x, pattern = "")

## S4 method for signature 'optimiser'
.DollarNames(x, pattern = "")

## S3 method for class 'preprocess'
.DollarNames(x, pattern = "")

## S4 method for signature 'preprocess'
.DollarNames(x, pattern = "")
```
### S3 method for class 'resampler'
.DollarNames(x, pattern = "")

### S4 method for signature 'resampler'
.DollarNames(x, pattern = "")

**Arguments**

- **x**: a struct_class object
- **pattern**: the text used to compare against the slot names

**Value**

A vector of slot names

---

**Description**

Prints a block of code that can be used to replicate the input object.

**Usage**

as.code(M, start = "M = ", mode = "compact", quiet = FALSE)

### S4 method for signature 'struct_class'
as.code(M, start = "M = ", mode = "compact", quiet = FALSE)

### S4 method for signature 'model_seq'
as.code(M, start = "M = ", mode = "compact", quiet = FALSE)

### S4 method for signature 'iterator'
as.code(M, start = "M = ", mode = "compact", quiet = FALSE)

**Arguments**

- **M**: a struct model, model_seq or iterator object
- **start**: text prepended to the code. Default is "M = "
- **mode**: "compact" will use the least amount of lines, "expanded" will put each object and input on a new line. "neat" will produce an output somewhere between "compact" and "expanded".
- **quiet**: TRUE or FALSE to print code to console
as.DatasetExperiment

Value

A string of code to reproduce the input object.
a string of code to reproduce the model
a string of code to reproduce the model sequence
a string of code to reproduce the iterator

Examples

M = example_model(value_1 = 10)
as.code(M)
M = example_model()
as.code(M)
M = example_model()
as.code(M)
M = example_model()
as.code(M)

as.DatasetExperiment  Convert a SummarizedExperiment to DatasetExperiment

Description

Converts a SummarizedExperiment to DatasetExperiment. The assay data is transposed, and col-
Data and rowData switched to match. struct specific slots such as "name" and "description" are
extracted from the metaData.

Usage

as.DatasetExperiment(obj)

Arguments

obj a SummarizedExperiment object

Value

a DatasetExperiment object
as.DatasetExperiment,SummarizedExperiment-method

Convert a SummarizedExperiment to DatasetExperiment

Description
The assay data is transposed, and colData and rowData switched to match. Struct specific slots such as "name" and "description" are extracted from the metaData if available. NB Any additional metadata will be lost during this conversion.

Usage
## S4 method for signature 'SummarizedExperiment'
as.DatasetExperiment(obj)

Arguments
obj a SummarizedExperiment object

Value
a DatasetExperiment object

as.SummarizedExperiment

Convert a DatasetExperiment to a SummarizedExperiment

Description
Converts a DatasetExperiment to SummarizedExperiment. The assay data is transposed, and colData and rowData switched to match. Struct specific slots such as "name" and "description" are stored in the metaData.

Usage
as.SummarizedExperiment(obj)

Arguments
obj a DatasetExperiment object

Value
a SummarizedExperiment object
as.SummarizedExperiment,\texttt{DatasetExperiment}-method

\textit{Convert a \texttt{DatasetExperiment} to \texttt{SummarizedExperiment}}

\textbf{Description}

Converts a \texttt{DatasetExperiment} to \texttt{SummarizedExperiment}. The assay data is transposed, and colData and rowData switched to match. struct specific slots such as "name" and "description" are stored in the metaData.

\textbf{Usage}

\begin{verbatim}
## S4 method for signature 'DatasetExperiment'
as.SummarizedExperiment(obj)
\end{verbatim}

\textbf{Arguments}

\begin{itemize}
\item \texttt{obj} a \texttt{DatasetExperiment} object
\end{itemize}

\textbf{Value}

a \texttt{SummarizedExperiment} object

\textbf{as\_data\_frame} \hspace{1cm} \textit{convert to data.frame}

\textbf{Description}

Most often used with univariate statistics to gather all the different outputs in a consistent format.

\textbf{Usage}

\begin{verbatim}
as_data_frame(M, \ldots)
\end{verbatim}

\textbf{Arguments}

\begin{itemize}
\item \texttt{M} a struct object
\item \ldots other inputs passed through this function
\end{itemize}

\textbf{Value}

a \texttt{data.frame} containing outputs from an object
**c,ontology_list-method**

*catenate ontology_lists*

**Description**

ontology_lists can be catenated with other ontology lists or with ontology_items.

**Usage**

```r
## S4 method for signature 'ontology_list'
c(x, ...)
```

**Arguments**

- `x`: an ontology_list()
- `...`: any number of ontology_list() or ontology_item() objects to catenate

**Value**

an ontology_list()

---

**calculate**  

*Calculate metric*

**Description**

A class for metrics to assess performance of e.g. models, iterators. Not intended to be called directly, this class should be inherited to provide functionality for method-specific classes.

**Usage**

```r
calculate(obj, ...)
value(obj)
value(obj) <- value
max_length(obj) <- value
metric(...)  
```

```r
## S4 method for signature 'metric'
calculate(obj, Y, Yhat)
```
## S4 method for signature 'metric'
value(obj)

## S4 replacement method for signature 'metric'
value(obj) <- value

**Arguments**

- **obj** a metric object
- **...** named slots and their values.
- **value** value
- **Y** the true class labels
- **Yhat** the predicted class labels

**Value**

value the calculated value of a metric

a metric object

**Examples**

```r
MET = metric()
calculate(MET)
MET = metric()
M = metric()
calculate(M,Y,Yhat)
MET = metric()
value(MET)
MET = metric()
value(MET) = 10
```

---

**chart** Constructor for struct chart objects

**Description**

A base class in the **struct** package. Should not be called directly.

**Usage**

```
chart(...)  
```

**Arguments**

```
...  
```  

named slots and their values that get passed to struct_class
Details

The chart class provides a template for figures, charts and plots associated with other objects. For example, a DatasetExperiment object could have a histogram plotted for a specified column.

Charts can have parameters but not outputs (other than the figure itself), as chart objects are not intended to be used for calculations. The chart_plot method can be used to display a chart for an object, and chart_names can be used to list all chart objects associated with an object.

Classes that inherit the stato class have STATO integration enabled, allowing stato_id to be set and formal names and descriptions pulled from the STATO ontology database.

Value

- a chart object
- a struct_class object

Examples

C = example_chart()

<table>
<thead>
<tr>
<th>chart_names</th>
<th>chart names</th>
</tr>
</thead>
</table>

Description

Returns a list of valid charts for a struct object

Usage

chart_names(obj, ret = "char")

## S4 method for signature 'struct_class'
chart_names(obj, ret = "char")

Arguments

- obj: An object derived from the struct_class object
- ret: A string indicating whether a list of objects ('obj') or a list of chart names ('char') is returned. 'char' is default.

Details

The chart_names method searches chart objects that specify the input object type as an input.

Value

- list of chart names, or a list of chart objects
Methods (by class)

- struct_class:

Examples

\[
\begin{align*}
M &= \text{example_model}() \\
\text{chart_names}(M) &\# 'example_chart' \\
\text{chart_names}(M,'\text{char}') &\# \text{as above} \\
\text{chart_names}(M,'\text{obj}') &\# \text{returns a list of chart objects}
\end{align*}
\]

Description

Plots a chart object

Usage

\[
\text{chart_plot}(\text{obj}, \text{dobj}, \ldots)
\]

## S4 method for signature 'chart,ANY'

\[
\text{chart_plot}(\text{obj}, \text{dobj})
\]

Arguments

- \text{obj} A chart object
- \text{dobj} An object derived from struct_class
- ... optional inputs

Details

The optional optional inputs depend on the input object/chart, but might include an additional dataset object or a second model object, for example.

Value

a plot object

Methods (by class)

- \text{obj} = \text{chart, dobj} = \text{ANY}:

Examples

\[
\begin{align*}
C &= \text{example_chart}() \\
\text{chart_plot}(C, \text{iris_DatasetExperiment})
\end{align*}
\]
citations

Citations for an object

Description
All struct objects have a "citations" slot, which is a list of references in bibtex format. The citations method gathers citations from an object and all struct objects that it inherits to generate a complete list.

Usage
citations(obj)

## S4 method for signature 'struct_class'
citations(obj)

Arguments
obj a struct object

Value
a character array of citations

Examples
D = iris_DatasetExperiment()
D$citations # the list specifically defined for this object
citations(D) # the list for this object and all inherited ones

DatasetExperiment

DatasetExperiment class

Description
An object for holding raw data and associated meta data

Usage
DatasetExperiment(
  data = data.frame(),
  sample_meta = data.frame(),
  variable_meta = data.frame(),
  ...
)

## S4 method for signature 'DatasetExperiment'

```r
x$name
```

## S4 replacement method for signature 'DatasetExperiment'

```r
x$name <- value
```

### Arguments

- **data**: A data frame with samples in rows and features in columns
- **sample_meta**: A data frame with samples in rows and meta data in columns
- **variable_meta**: A data frame with features in rows and meta data in columns
- **...**: named slot values to pass through to struct_class
- **x**: A DatasetExperiment object
- **name**: DatasetExperiment slot to get/set
- **value**: the value to assign to the named slot

### Details

The `DatasetExperiment` object is an extension of the `SummarizedExperiment` object from the `SummarizedExperiment` package (found on Bioconductor). It incorporates the basic functionality of struct objects, containing fields such as Description, Name and Type with features of `SummarizedExperiment` such as subsetting.

There are some important differences between `DatasetExperiment` and `SummarizedExperiment`:

- In `DatasetExperiment` data is stored as Samples (rows) x Features (columns)
- `DatasetExperiment` currently only supports a single assay
- `length(DatasetExperiment)` returns the number of samples

### Value

`DatasetExperiment`

### Slots

- **name**: Name of the dataset
- **description**: Brief description of the dataset
- **type**: The type of dataset e.g. single_block
**Description**
A base class in the `struct` package. Should not be called directly.

**Usage**

```r
entity_stato(
  name,
  description = character(0),
  type = "character",
  value = NULL,
  max_length = Inf,
  stato_id
)
```

**Arguments**

- **name**: the name of the object
- **description**: a description of the object
- **type**: the type of the struct object
- **value**: The value of the parameter/outputs
- **max_length**: Maximum length of value vector (default 1)
- **stato_id**: The STATO ID for the entity

**Details**
Extends the `entity` class to include stato functionality.

**Value**
an `entity_stato` object

**See Also**
Refer to `entity` and `stato` for further info.

**Examples**

```r
E = entity_stato(
  name = 'example',
  description = 'this is an example',
  type = 'numeric',
  value = 1,
  stato_id='XYZ000001'
)
```
Description

A base class in the **struct** package. Not normally called directly.

Usage

```r
elem(
  name,
  description = character(0),
  type = "character",
  value = character(0),
  max_length = 1,
  allowed,
  ...
)
```

## S4 replacement method for signature 'enum'
value(obj) <- value

Arguments

- **name**: the name of the object
- **description**: a description of the object
- **type**: the type of the struct object
- **value**: value of the enum
- **max_length**: Maximum length of value vector (default 1)
- **allowed**: A list of allowed values
- **obj**: an enum object

Details

An enum object is a special type of entity object that ensures the value must be one from a list of allowed values.

Enum objects are usually defined in the prototype of another object, but can be extracted using `param_obj` and `output_obj`.

Value

an enum object
enum_stato

Examples

```r
# Create a new enum object
E = enum(
  name = 'example',
  description = 'this is an example',
  type = 'character',
  value = 'hello',
  allowed = c('hello', 'world')
)

# Get/set the value of the entity object
value(E)
value(E) = 'world'
```

description

A base class in the struct package. Should not be called directly.

Usage

```r
description

Arguments

name the name of the object
description a description of the object
type the type of the struct object
value The value of the parameter/outputs
max_length Maximum length of value vector (default 1)
allowed A list of allowed values
stato_id The STATO ID for the entity
```

details

Extends the enum class to include stato functionality.
Value

an enum_stato object

See Also

Refer to enum and stato for further info.

Examples

```r
E = enum_stato(
    name='example',
    allowed=list('choice_1','choice_2'),
    value='choice_1',
    type='character',
    stato_id='XYZ000001'
)
```

Description

an example of a chart object for documentation purposes

Usage

```r
e.example_chart(...)
```

## S4 method for signature 'example_chart,example_model'

```r
chart_plot(obj, dobj)
```

Arguments

... named slots and their values.

obj a chart object
dobj a example_model object

Value

a chart object

Examples

```r
C = example_chart()
chart_plot(C,example_model())
```
**example_iterator-class**

*Example iterator*

**Description**

An example iterator for testing

runs the example iterator, which just returns a value of 3.142

**Usage**

```r
## S4 method for signature 'example_iterator,DatasetExperiment,metric'
run(I, D, MET)
```

**Arguments**

- `I`: example_iterator object
- `D`: dataset object
- `MET`: metric object

**Value**

- test iterator object
- dataset object

**Examples**

```r
I = example_iterator()
I = example_iterator()
D = iris_DatasetExperiment()
MET = metric()
I = run(I,D,MET)
```

**example_model**

*Example model*

**Description**

An example model for testing. Training this model adds value_1 to a data set, and prediction using this model adds value_2.

trains the example model, which adds value_1 to the raw data of a dataset

predicts using the example model, which adds value_2 to the raw data of a dataset
Usage

```
example_model(value_0 = 0, value_1 = 10, value_2 = 20, ...)
```

```R
## S4 method for signature 'example_model,DatasetExperiment'
model_train(M, D)
```

```R
## S4 method for signature 'example_model,DatasetExperiment'
model_predict(M, D)
```

**Arguments**

- `value_0`  a numeric value
- `value_1`  a numeric value
- `value_2`  a numeric value
- `...`  named slots and their values.
- `M`  A struct model object
- `D`  A DatasetExperiment object

**Value**

- modified example_model object
- dataset object
- dataset object

**Examples**

```
M = example_model()
M = example_model(value_1 = 10, value_2 = 20)
D = iris_DatasetExperiment()
M = example_model(value_1 = 10, value_2 = 20)
M = model_train(M,D)
D = iris_DatasetExperiment()
M = example_model(value_1 = 10, value_2 = 20)
M = model_predict(M,D)
```

---

`export_xlsx`  
`write a dataset object to file`

**Description**

Exports a dataset object to an excel file with sheets for data, sample_meta and variable_meta
Usage

export_xlsx(object, outfile, transpose = TRUE)

## S4 method for signature 'DatasetExperiment'
export_xlsx(object, outfile, transpose = TRUE)

Arguments

object      a dataset object
outfile     the filename (including path) to write the data to
transpose   TRUE (default) or FALSE to transpose the output data

Value

an excel file with sheets for data and meta data

Examples

## Not run:
D = iris_DatasetExperiment() # example dataset
export_xlsx(D,'iris_DatasetExperiment.xlsx')

## End(Not run)

iris_DatasetExperiment

Fisher’s Iris data

Description

Fisher’s Iris data as a DatasetExperiment object

Usage

iris_DatasetExperiment()

Value

DatasetExperiment object

Examples

D = iris_DatasetExperiment()
is_output  Verify output

Description
Verify that the name of an output is valid for an object

Usage

is_output(obj, name)

### S4 method for signature 'struct_class'

is_output(obj, name)

Arguments

- **obj**: A model or iterator object derived from the *struct* class
- **name**: Name of output

Value
TRUE if output name is valid, FALSE if not

Methods (by class)

- *struct_class:*

Examples

M = example_model()
is_output(M, 'result_1')  # TRUE
is_output(M, 'result_0')  # FALSE

is_param  Verify parameter

Description
Verify that the input name is a valid input parameter for an object

Usage

is_param(obj, name)

### S4 method for signature 'struct_class'

is_param(obj, name)
**Arguments**

- `obj`  
  An object derived from `struct_class`

- `name`  
  Name of parameter

**Value**

TRUE if parameter name is valid, FALSE if not

**Methods (by class)**

- `struct_class`:

**Examples**

```r
M = example_model()
is_param(M,'value_1')  # TRUE
is_param(M,'alpha')  # FALSE
```

---

**libraries**  
*Libraries for an object*

**Description**

All `struct` objects have a "libraries" slot, which is a character array of libraries required to use the object. The `libraries` method gathers libraries from an object and all `struct` objects that it inherits to generate a complete list.

**Usage**

```r
libraries(obj)
```

## S4 method for signature 'struct_class'

```r
libraries(obj)
```

**Arguments**

- `obj`  
  a `struct` object

**Value**

a character array of R packages needed by the object

**Examples**

```r
M = example_model()
libraries(M)
```
max_length

get the max value vector length for an entity

Description

A base class in the struct package. Not normally called directly. An entity object is used to store information about a parameter or output. The standard 'name', 'description' and 'type' slots are included, along with 'value' for storing the value of the parameter and 'max_length' for restricting the length of 'value' if needed.

Usage

max_length(obj)

description

entity(
  name,
  description = character(0),
  type = "character",
  value = NULL,
  max_length = Inf,
  ...
)

## S4 method for signature 'entity'
value(obj)

## S4 replacement method for signature 'entity'
value(obj) <- value

## S4 method for signature 'entity'
max_length(obj)

## S4 replacement method for signature 'entity'
max_length(obj) <- value

Arguments

obj An entity object
name the name of the object
description a description of the object
type the type of the struct object
value The value of the parameter/outputs
max_length Maximum length of value vector (default 1)
... additional inputs to the struct_class object
Details

Entity objects are usually defined in the prototype of another object, but can be extracted using \texttt{param_obj} and \texttt{output_obj}.

Value

max value vector length for an entity

An entity object

Examples

```r
# Create a new entity object
E = entity(
  name = 'example',
  description = 'this is an example',
  type = 'numeric',
  value = 1
)

# Get/set the value of the entity object
value(E)
value(E) = 10
```

model

\textit{model class}

Description

A class for models that can be trained/applied to datasets e.g. PCA, PLS etc. Also used for preprocessing steps that require application to test sets. Not intended to be called directly, this class should be inherited to provide functionality for method-specific classes.

Usage

```r
model(
  predicted = character(0),
  seq_in = "data",
  seq_fcn = function(x) { return(x) },
  ...
)
```

```r
## S4 method for signature 'model,DatasetExperiment'
model_train(M, D)

## S4 method for signature 'model,DatasetExperiment'
model_predict(M, D)
```

```r
## S4 method for signature 'model,DatasetExperiment'
```
model_apply(M, D)
## S4 method for signature 'model,DatasetExperiment'
model_reverse(M, D)
## S4 method for signature 'model'
predicted(M)
## S4 method for signature 'model'
seq_in(M)
## S4 replacement method for signature 'model,character'
seq_in(M) <- value
## S4 method for signature 'model'
predicted_name(M)
## S4 replacement method for signature 'model,character'
predicted_name(M) <- value

Arguments

<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>predicted</td>
<td>The name of an output slot to return when using predicted() (see details)</td>
</tr>
<tr>
<td>seq_in</td>
<td>The name of an output slot to connect with the &quot;predicted&quot; output of another model (see details)</td>
</tr>
<tr>
<td>seq_fcn</td>
<td>A function to apply to seq_in before inputting into the next model. Typically used to extract a single column, or convert from factor to char etc.</td>
</tr>
<tr>
<td>...</td>
<td>Named slots and their values.</td>
</tr>
<tr>
<td>M</td>
<td>A struct model object</td>
</tr>
<tr>
<td>D</td>
<td>A DatasetExperiment object</td>
</tr>
<tr>
<td>value</td>
<td>The value to assign</td>
</tr>
</tbody>
</table>

Value

- trained model object
- model object with test set results
- trained model object
- dataset dataset object with the reverse model applied
- the predicted output, as specified by predicted_name
- the id of the input parameter to be replaced by the predicted output of the previous model in a model sequence. Reserved keyword 'data' means that the input data used by model_train, model_apply etc is used. seq_in = 'data' is the default setting.
- the modified model object
- the id of the output returned by predicted()
- the modified model object
predicted slot

The "predicted" slot is a slots for use by users to control the flow of model sequences. The predicted() function is used to return a default output and from a model. Typically it is a DatasetExperiment object that is passed directly into the next model in a sequence as the data for that model.

seq_in slot

In a sequence of models (see model_seq) the "predicted" slot is connected to the DatasetExperiment input of the next model. seq_in can be used to control flow and connect the "predicted" output to the input parameter of the next model. Default is the keyword 'data', and can otherwise be replaced by any input slot from the model. The slot seq_fcn can be used to apply a transformation to the output before it is used as an input. This allows you to e.g. convert between types, extract a single column from a data.frame etc.

Examples

```r
M = model()
D = DatasetExperiment()
M = model()
M = model_train(M,D)
D = DatasetExperiment()
M = model()
M = model_train(M,D)
M = model_predict(M,D)
D = DatasetExperiment()
M = model()
M = model_apply(M,D)
D = DatasetExperiment()
M = model()
M = model_train(M,D)
M = model_predict(M,D)
M = model_reverse(M,D)
D = DatasetExperiment()
M = example_model()
M = model_train(M,D)
M = model_predict(M,D)
p = predicted(M)
D = DatasetExperiment()
M = example_model()
seq_in(M) = 'data'
M = example_model()
seq_in(M) = 'value_1'
M = example_model()
predicted_name(M)
M = example_model()
predicted_name(M) = 'result_2'
```
models

Get/set models of a model_seq

Description

Returns the list of models in a model_seq object

Usage

models(ML)

models(ML) <- value

Arguments

ML a model_seq object
value a list containing only model objects

Value

models(ML) returns a list of models in the model sequence
models(ML) <- sets the list of models in the model sequence

Examples

# Create a model sequence
ML = model_seq()
models(ML) = list(example_model(), example_model())
models(ML)

model_apply

Apply a model

Description

Applies a method to the input dataset

Usage

model_apply(M, D)

Arguments

M a 'method' object
D another object used by the first
model_predict

Value

Returns a modified method object

Examples

M = example_model()
M = model_apply(M, iris_DatasetExperiment())

model_reverse

Reverse preprocessing

Description

Reverse the effect of a preprocessing step on a dataset.

Usage

model_reverse(M, D)

Arguments

M a model object
D a dataset object

Value

Returns a modified model object

Examples

M = example_model()
M = model_predict(M, iris_DatasetExperiment())
Arguments

- M: a model object
- D: a dataset object

Value

Returns a modified dataset object

Examples

```r
M = example_model()
D = model_reverse(M, iris.DatasetExperiment())
```

---

**Description**

A class for (ordered) lists of models

**Usage**

```r
model_seq(...)  
# S4 method for signature 'model_seq, DatasetExperiment'
model_train(M, D)
# S4 method for signature 'model_seq, DatasetExperiment'
model_predict(M, D)
# S4 method for signature 'model_seq, ANY, ANY, ANY'
x[i]
# S4 replacement method for signature 'model_seq, ANY, ANY, ANY'
x[i] <- value
# S4 method for signature 'model_seq'
models(ML)
# S4 replacement method for signature 'model_seq, list'
models(ML) <- value
# S4 method for signature 'model_seq'
length(x)
# S4 method for signature 'model, model_seq'
e1 + e2
```
## S4 method for signature 'model_seq,model'
e1 + e2

## S4 method for signature 'model,model'
e1 + e2

## S4 method for signature 'model_seq'
predicted(M)

## S4 method for signature 'model_seq,DatasetExperiment'
model_apply(M, D)

### Arguments

... named slots and their values.
M a model object
D a dataset object
x a model_seq object
i index
value value
ML a model_seq object
e1 a model or model_seq object
e2 a model or model_seq object

### Value

model sequence
model sequence
model at the given index in the sequence
model sequence with the model at index i replaced
a list of models in the sequence
a model sequence containing the input models
the number of models in the sequence
a model sequence with the additional model appended to the front of the sequence
a model sequence with the additional model appended to the end of the sequence
a model sequence
the predicted output of the last model in the sequence
Examples

```python
MS = model_seq()
MS = model() + model()
MS = example_model() + example_model()
MS = model_train(MS, DatasetExperiment())
D = DatasetExperiment()
MS = example_model() + example_model()
MS = model_train(MS, D)
MS = model_predict(MS, D)
MS = model() + model()
MS[2]

MS = model() + model()
MS[3] = model()

MS = model() + model()
L = models(MS)

MS = model_seq()
L = list(model(), model())
models(MS) = L

MS = model() + model()
length(MS) # 2

MS = model() + model()
M = model()
MS = M + MS

MS = model() + model()
M = model()
MS = MS + M

MS = model() + model()

D = DatasetExperiment()
M = example_model()
M = model_train(M, D)
M = model_predict(M, D)
p = predicted(M)
D = DatasetExperiment()
MS = example_model() + example_model()
MS = model_apply(MS, D)
```

---

**model_train**

*Train a model*

**Description**

Trains a model using the input dataset
Usage

model_train(M, D)

Arguments

M a model object
D a dataset object

Value

Returns a modified model object

Examples

M = example_model()
M = model_train(M, iris.DatasetExperiment())

new_struct

Generate a struct object from a Class

Description

This function creates a newly allocated object from the class identified by the first argument. It works almost identically to new but is specific to objects from the struct package and ensures that entity slots have their values assigned correctly. This function is usually called by class constructors and not used directly.

Usage

new_struct(class, ...)

Arguments

class The class of struct object to create
... named slots and values to assign

Value

An object derived from struct_class

Examples

S = new_struct('struct_class')
ontology

**Ontology for an object**

Description

All struct objects have an "ontology" slot, which is a list of ontology items for the object. The `ontology` method gathers ontology items from an object and all struct objects that it inherits to generate a complete list.

A base class in the struct package. Stores ontology information e.g. term, description, id etc for struct objects and provides methods for populating these fields using the ‘rols’ package.

A base class in the struct package. Stores multiple ‘ontology_term’ objects.

Usage

```r
ontology(obj, cache = NULL)

ontology_term(
  id,
  ontology = character(),
  label = character(),
  description = character(),
  iri = character(),
  rols = TRUE
)

ontology_list(terms = list())

## S4 method for signature 'ontology_list,ANY,ANY,ANY'
## S4 replacement method for signature 'ontology_list,ANY,ANY,ANY'
## S4 method for signature 'ontology_list'
length(x)

## S4 method for signature 'struct_class'
ontology(obj, cache = NULL)
```

Arguments

- **obj**
  - a struct object

- **cache**
  - a named list of ontology_terms for offline use. Terms from the cache are search based on the name of the list items matching the ontology id. If cache=NULL then the OLS API is used to lookup terms.

- **id**
  - (character) The ontology term id e.g. 'STATO:0000555'
ontology (character) The ontology the term is a member of e.g. 'stato'
label (character) The label for the ontology term
description (character) The description of the term
iri (character) The Internationalized Resource Identifier for the term
rols (logical) TRUE or FALSE to query the Ontology Lookup Service for missing label, description or iri if not provided as input. Default rols = TRUE
terms A list of ontology_term objects.
x the list
i The list item index
value an ontology_term() object

Value

model at the given index in the sequence
model sequence with the model at index i replaced
the number of models in the sequence

Examples

M = example_model()
ontology(M,cache=NULL)
## Not run:
OT = ontology_term(id='STATO:0000555')

## End(Not run)
## Not run:
OT = ontology_list(terms=list(
    ontology_term(ontology='obi',id = 'OBI:0200051'),
    ontology_term(ontology='stato',id = 'STATO:0000555')
))

## End(Not run)
## Not run:
OL = ontology_list('STATO:0000555')
OL[1]

## End(Not run)
## Not run:
OL = ontology_list('STATO:0000555')
OL[1] = ontology_term('STATO:0000302')

## End(Not run)
## Not run:
OL = ontology_list()
length(OL) # 0

## End(Not run)
optimiser

**Description**

A special class of iterator for selecting optimal parameter values not intended to be called directly, this class should be inherited to provide functionality for method-specific classes.

**Usage**

```r
optimiser(...)```

**Arguments**

```r
... named slots and their values.
```

**Value**

an optimiser object

**Examples**

```r
OPT = optimiser()
```

---

output_ids

**Description**

return a list of valid output ids for an object

**Usage**

```r
output_ids(obj)
```

**Arguments**

```r
obj A model or iterator object derived from the *struct* class
```

**Value**

list of output ids
Methods (by class)

• struct_class:

Examples

M = example_model()
output_ids(M)

output_list

Description

get/set a named list of outputs and their current value for an object

Usage

output_list(obj)
output_list(obj) <- value

## S4 method for signature 'struct_class'
output_list(obj)

## S4 replacement method for signature 'struct_class,list'
output_list(obj) <- value

Arguments

obj An object derived from struct_class
value A named list of outputs and corresponding values

Value

A named list of outputs and corresponding values

struct object

Methods (by class)

• struct_class:

• obj = struct_class,value = list:

Examples

M = example_model()
L = output_list(M)
M = example_model()
output_list(M) = list('result_1' = DatasetExperiment(),'result_2' = DatasetExperiment())
output_name

### Description

return a the name for a output, if available

### Usage

output_name(obj, name)

```r
## S4 method for signature 'struct_class,character'
output_name(obj, name)
```

### Arguments

- `obj`: A model or iterator object derived from the *struct* class
- `name`: Name of output

### Value

name of output

### Methods (by class)

- `obj = struct_class,name = character`

### Examples

```r
M = example_model()
output_name(M,'result_1')
```

---

output_obj

### Description

Gets or sets the object of an output e.g. to an entity() object.
Usage

output_obj(obj, name)

output_obj(obj, name) <- value

## S4 method for signature 'struct_class,character'
output_obj(obj, name)

## S4 replacement method for signature 'struct_class,character'
output_obj(obj, name) <- value

Arguments

obj A model or iterator object derived from the *struct* class
name Name of output
value A valid value for the output being set

Value

output_obj(M,name) returns the named output as an object
output_obj(M,name)<- sets the named output of an object
the modified object

Methods (by class)

• obj = struct_class,name = character:
• obj = struct_class,name = character:

Examples

# get the output as an object
M = example_model()
obj = output_obj(M, 'result_1')

# set a output as an object
output_obj(M, 'result_1') = entity(value = 15,type = 'numeric',name = 'result_1')

Description

get/set the values for an output_
Usage

\[
\text{output_value}(\text{obj}, \text{name})
\]

\[
\text{output_value}(\text{obj}, \text{name}) \leftarrow \text{value}
\]

## S4 method for signature 'struct_class, character'
\[
\text{output_value}(\text{obj}, \text{name})
\]

## S4 replacement method for signature 'struct_class, character'
\[
\text{output_value}(\text{obj}, \text{name}) \leftarrow \text{value}
\]

Arguments

- **obj**: A model or iterator object derived from the *struct* class
- **name**: Name of output
- **value**: A valid value for the output being set

Value

Value of output
struct object

Methods (by class)

- obj = struct_class, name = character:
- obj = struct_class, name = character:

Examples

\[
\text{M} = \text{example_model()}
\]
\[
\text{output_value(M, 'result_1')}
\]
\[
\text{M} = \text{example_model()}
\]
\[
\text{output_value(M, 'result_1') = DatasetExperiment()}
\]

---

**param_ids**

*Parameter identifiers*

Description

return a list of valid parameter ids for an object

Usage

\[
\text{param_ids}(\text{obj})
\]

## S4 method for signature 'struct_class'
\[
\text{param_ids}(\text{obj})
\]
Arguments

obj An object derived from struct_class

Value

list of parameter ids

Methods (by class)

• struct_class:

Examples

M = example_model()
param_ids(M)

param_list

Parameter list

Description

get/set a named list of parameters and their current value for an object

Usage

param_list(obj)

param_list(obj) <- value

## S4 method for signature 'struct_class'
param_list(obj)

## S4 replacement method for signature 'struct_class,list'
param_list(obj) <- value

Arguments

obj An object derived from struct_class

value A named list of parameters and corresponding values

Value

A named list of parameters names and corresponding values

Methods (by class)

• struct_class:

• obj = struct_class,value = list:
### Examples

```r
M = example_model()
L = param_list(M)

M = example_model()
param_list(M) = list('value_1' = 15,'value_2' = 20)
```

<table>
<thead>
<tr>
<th>param_name</th>
<th>Parameter name</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Description

Returns the name for a parameter, if available.

### Usage

```r
c param_name(obj, name)
```

```r
# S4 method for signature 'struct_class,character'
c param_name(obj, name)
```

### Arguments

- `obj`: An object derived from `struct_class`
- `name`: Name of parameter

### Value

name of parameter

### Methods (by class)

- `obj = struct_class,name = character`

### Examples

```r
M = example_model()
c param_name(M,'value_1')
```
Description

Gets or sets the object of a parameter e.g. to an entity() object.

Usage

```r
param_obj(obj, name)
```

```r
param_obj(obj, name) <- value
```

```r
## S4 replacement method for signature 'struct_class,character'
param_obj(obj, name) <- value
```

```r
## S4 method for signature 'struct_class,character'
param_obj(obj, name)
```

Arguments

- **obj**: An object derived from struct_class
- **name**: Name of parameter
- **value**: A valid value for the parameter being set

Value

- `param_obj(M, name)` Returns the named parameter as an object
- `param_obj(M, name) <-` Sets the named parameter of an object

Examples

```r
# get the parameter as an object
M = example_model()
obj = param_obj(M, 'value_0')
```

```r
# set a parameter as an object
param_obj(M, 'value_0') = entity(value = 15, type = 'numeric', name='value_0')
```
**param_value**

### Parameter values

**Description**
get/set the values for a parameter.

**Usage**

```r
param_value(obj, name)
param_value(obj, name) <- value
```

```r
## S4 method for signature 'struct_class,character'
param_value(obj, name)
## S4 replacement method for signature 'struct_class,character'
param_value(obj, name) <- value
```

**Arguments**

- **obj**  
  A model or iterator object derived from structclass

- **name**  
  Name of parameter

- **value**  
  A valid value for the parameter being set

**Value**

Value of parameter

**Methods (by class)**

- `obj = struct_class,name = character`
- `obj = struct_class,name = character`

**Examples**

```r
M = example_model()
param_value(M,'value_1')
```

```r
M = example_model()
param_value(M,'value_1') = 0.95
```
**predicted**

<table>
<thead>
<tr>
<th>predicted</th>
<th>Prediction output</th>
</tr>
</thead>
</table>

**Description**

returns the prediction output for a model. This is supplied as input to the next model when used in a model_seq.

**Usage**

predicted(M)

**Arguments**

M a model object

**Value**

The value returned varies depending on the output.

**Examples**

```r
M = example_model()
M = model_train(M, iris_DatasetExperiment())
M = model_predict(M, iris_DatasetExperiment())
predicted(M)
```

---

**predicted_name**

<table>
<thead>
<tr>
<th>predicted_name</th>
<th>Predicted output name</th>
</tr>
</thead>
</table>

**Description**

get/set the prediction output for a model. This determines which outputs from this model are supplied as inputs to the next model when used in a model_seq.

**Usage**

predicted_name(M)

predicted_name(M) <- value

**Arguments**

M a model object

value name of an output for this model
Value

predicted_name returns the name of the predicted output
predicted_name<- sets the name of the predicted output

Examples

M = example_model()
predicted_name(M)
predicted_name(M) = 'result_2'

Description

A class used for preprocessing steps that require application to test sets. Not intended to be called directly, this class should be inherited to provide functionality for method-specific classes.

Usage

preprocess(...)

## S4 method for signature 'preprocess,DatasetExperiment'
model_reverse(M, D)

Arguments

... named slots and their values.
M a model object
D a dataset object

Value

dataset object

Examples

M = preprocess()
D = DatasetExperiment()
M = model()
D2 = model_reverse(M,D)
Description
A class for resampling methods such as cross-validation. not intended to be called directly.

Usage
resampler(...)

Arguments
... named slots and their values.

Value
a resampler object

Examples
R = resampler()

Description
Returns the results of an iterator. This is used to control model flow in a similar way to predict for model and model_seq objects.

Usage
result(M)

Arguments
M an iterator object

Value
the returned output varies with the algorithm implemented
result_name

get/set output name as prediction output for a model

Description

get/set the prediction output for a model. This determines which outputs from this model are supplied as inputs to the next model when used in a model_seq.

Usage

result_name(M)

result_name(I) <- value

Arguments

M an iterator object
I an iterator object
value name of an output for iterator M

Value

result_name(M) returns the name of the output for this iterator (equivalent to predicted for model objects)

result_name(I) <- sets the default output for an iterator

Examples

I = example_iterator() # initialise iterator
result_name(I)
result_name(I) = 'result_1'
### Description

Runs an iterator, applying the chosen model multiple times.

Evaluates an iterator by e.g. averaging over all iterations. May be deprecated in a future release as evaluate is applied by run anyway.

A class for iterative approaches that involve the training/prediction of a model multiple times. Not intended to be called directly, this class should be inherited to provide functionality for method-specific classes.

### Usage

```r
run(I, D, MET)
evaluate(I, MET)
iterator(...)
```

```r
def run(I, D, MET = NULL)
def evaluate(I, MET)
def models(ML)
def models(ML) <- value
```

```r
def result_name(I) <- value
def result(M)
def result(M)
def result_name(M)
def e1 * e2
def x[i]
```
## S4 replacement method for signature 'iterator,ANY,ANY,ANY'
x[i] <- value

### Arguments

- **I**: an iterator object
- **D**: a dataset object
- **MET**: a metric object
- ... named slots and their values.
- **ML**: a model sequence object
- **value**: value
- **M**: a model object
- **e1**: an iterator object
- **e2**: an iterator or a model object
- **x**: a sequence object
- **i**: index into sequence

### Details

Running an iterator will apply the iterator a number of times to a dataset. For example, in cross-validation the same model is applied multiple times to the same data, splitting it into training and test sets. The input metric object can be calculated and collected for each iteration as an output.

### Value

Modified iterator object

Modified iterator object

the modified model object

model at the given index in the sequence

iterator with the model at index i replaced

### Examples

```r
d = iris_DatasetExperiment() # get some data
met = metric() # use a metric
i = example_iterator() # initialise iterator
models(i) = example_model() # set the model
i = run(i,d,met) # run
d = iris_DatasetExperiment() # get some data
met = metric() # use a metric
i = example_iterator() # initialise iterator
models(i) = example_model() # set the model
i = run(i,d,met) # run
i = evaluate(i,met) # evaluate
i = iterator()
```
### seq_in

**Sequence input**

*Description*

get/set the input parameter replaced by the output of the previous model in a model sequence. Default is "data" which passes the output as the data input for methods such as `model_train` and `model_apply`.

**Usage**

```r
seq_in(M)

seq_in(M) <- value
```

**Arguments**

- **M** a model object
- **value** name of an output for this model

**Value**

- `seq_in` returns the name of the input parameter replaced when used in a model sequence
- `seq_in<-` sets the name of the input parameter replaced when used in a model sequence

**Examples**

```r
M = example_model()
seq_in(M)
seq_in(M) = 'value_1'
```
set_obj_method  

update method for a struct object

Description

a helper function to update methods for a struct object

Usage

```r
set_obj_method(
  class_name, method_name, definition,
  where = topenv(parent.frame()),
  signature = c(class_name, "DatasetExperiment")
)
```

Arguments

- **class_name**: the name of the to update the method for
- **method_name**: the name of the method to update. Must be an existing method for the object.
- **definition**: the function to replace the method with. This function will be used when the method is called on the object.
- **where**: the environment to create the object in. default where = topenv(parent.frame())
- **signature**: a list of classes that this object requires as inputs. Default is c(class_name,'DatasetExperiment')

Value

a method is created in the specified environment

Examples

```r
set_struct_obj(
  class_name = 'add_two_inputs',
  struct_obj = 'model',
  params = c(input_1 = 'numeric', input_2 = 'numeric'),
  outputs = c(result = 'numeric'),
  prototype = list(
    input_1 = 0,
    input_2 = 0,
    name = 'Add two inputs',
    description = 'example class that adds two values together')
)
```
set_obj_show  

**Description**

a helper function to update the show method for a struct object

**Usage**

```r
set_obj_show(class_name, extra_string, where = topenv(parent.frame()))
```

**Arguments**

- `class_name` the name of the to update the method for
- `extra_string` a function that returns an extra string using the input object as an input e.g. `function(object) return = 'extra_string'`
- `where` the environment to create the object in. default where = topenv(parent.frame())

**Value**

a method is created in the specified environment

**Examples**

```r
# create an example object first
def set_struct_obj(
    class_name = 'add_two_inputs',
    struct_obj = 'model',
    params = c(input_1 = 'numeric', input_2 = 'numeric'),
    outputs = c(result = 'numeric'),
    prototype = list(
        input_1 = 0,
        input_2 = 0,
        name = 'Add two inputs',
        description = 'example class that adds two values together')
)
def set_obj_show(
    class_name = 'add_two_inputs',
    extra_string = function(object) {return('The extra text')}
)
```
set_struct_obj  

**Description**

A helper function to create new struct objects

**Usage**

```r
set_struct_obj(
    class_name, 
    struct_obj, 
    params = character(0), 
    outputs = character(0), 
    private = character(0), 
    prototype = list()
)
```

**Arguments**

- **class_name**: the name of the new class to create
- **struct_obj**: the struct obj to inherit e.g. 'model’, 'metric’ etc
- **params**: a named character vector of input parameters where each element specifies the type of value that will be in the slot e.g. c(example = 'character')
- **outputs**: a named character vector of outputs where each element specifies the type of value that will be in the slot e.g. c(example = 'character’)
- **private**: a named character vector of private slots where each element specifies the type of value that will be in the slot e.g. c(example = 'character’). These are intended for internal use by the object and generally not available to the user.
- **prototype**: a named list with initial values for slots.

**Value**

A new class definition. To create a new object from this class use `X = new_class_name()`

---

**stato_id**

**Description**

A base class in the `struct` package. Provides several fundamental methods and should not be called directly.
Usage

stato_id(obj)
stato_name(obj)
stato_definition(obj)
stato_summary(obj)

stato(stato_id)

## S4 method for signature 'stato'
stato_id(obj)

## S4 method for signature 'stato'
stato_name(obj)

## S4 method for signature 'stato'
stato_definition(obj)

## S4 method for signature 'stato'
stato_summary(obj)

Arguments

obj An object derived from the stato object
stato_id A STATO ID e.g. OBI:0000001

Details

STATO is the statistical methods ontology. It contains concepts and properties related to statistical methods, probability distributions and other concepts related to statistical analysis, including relationships to study designs and plots (see http://stato-ontology.org/).

This class provides access to a version of the STATO ontology database that can be searched by ontology id to provide formal names and definitions for methods, models, iterators, metrics and charts.

This class makes use of the ontologyIndex package to search a copy of the STATO database included in this package.

Value

id the stato id
name the stato name
def the stato description

Value returned depends on the method used.
Examples

M = example_model()
stato_id(M)
stato_name(M)
stato_definition(M)
stato_summary(M)
# an example stato object
M = example_model()

# the stato id assigned to object M
stato_id(M) # OBI:0000011

# the name associated with that id
stato_name(M)

# the STATO definition for that id
stato_definition(M)

# a summary of the STATO database entry for the id, and any parameters or
# outputs that also have stato ids.
stato_summary(M)

struct

StRUCT: Statistics in R Using Class Templates

Description

This package defines classes (templates) for developing statistical workflows. These classes can be extended using other packages, making it easier to combine methods from different packages into a robust workflow. Integration with STATO: the statistical methods ontology (https://www.ebi.ac.uk/ols/ontologies/stato) provides standardised definitions for many statistical methods.

Classes

The classes include:

- **DatasetExperiment**: An extension of the SummarizedExperiment object by Bioconductor
- **model**: A template for training and applying statistics
- **iterator**: A template for resampling, optimisation and validation of statistical models
- **chart**: A template for generating graphical outputs for models and iterators
struct_class

Constructor for struct_class objects

Description

Creates a new struct_class object and populates the slots. Not intended for direct use.

Usage

struct_class(
    name = character(0),
    description = character(0),
    type = character(0),
    citations = list(),
    ontology = character(0)
)

Arguments

name    the name of the object
description    a description of the object
type    the type of the struct object
citations    a list of citations for the object in "bibentry" format
ontology    a list of ontology items for the object in "ontology_item" format

Value

a struct_class object

struct_class-class    struct_class object definition

Description

Defines the struct class base template. This class is inherited by other objects and not intended for direct use. It defines slots and methods common to all struct objects.

Value

Returns a struct object
Public slots

Public slots can be accessed using shorthand $ notation and are intended for users building workflows.

- **name** character() A short descriptive name of the struct object
- **description** character() A longer description of the struct object and what it does
- **type** character() A keyword that describes the type of struct object
- **libraries** character() A (read only) list of R packages used by this struct object
- **citations** list of bibentry A (read only) list of citations relevant to this struct object, in Bibtex format.

Private slots

Private slots are not readily accessible to users and are intended for developers creating their own struct objects. Any slot not listed within `.params` or `.outputs` is considered a private slot.

- **.params** character() A list of additional slot names that can be get/set by the user for a specific struct object. These are used as input parameters for different methods.
- **.outputs** character() a list of additional slot names that can be get by the user. These are used to store the results of a method.

Examples

```r
S = struct_class(name = 'Example', description = 'An example object')
```

---

**struct_template**

*StRUCT templates*

**Description**

Create a struct template

**Usage**

```r
struct_template(
  template = "model",
  output,
  in_editor = TRUE,
  overwrite = FALSE
)
```

**Arguments**

- **template** the type of object you want a template for e.g. 'model'
- **output** the name/path of the output file
- **in_editor** TRUE/FALSE to open the created file in the default editor
- **overwrite** = TRUE/FALSE to overwrite file if exists already
test_metric-class

Value

A template is created at the output location specified

Examples

## Not run:
struct_template('model','example.R',FALSE)

## End(Not run)

description

An example metric for testing
calculates a metric, which just returns a value of 3.142

Usage

## S4 method for signature 'test_metric'
calculate(obj)

Arguments

obj metric object

Value

test metric object
dataset object

Examples

MET = test_metric()
MET = test_metric()
MET = calculate(MET)
\$\text{ontology\_list\_method}

\textit{Get/set ontology\_list slots}

Description

Dollar syntax can be used to as a shortcut for getting values for ontology\_list objects.

Usage

\[
\text{\#\# S4 method for signature 'ontology\_list'}
\]

\[x$name\]

Arguments

\begin{itemize}
  \item \texttt{x} \quad \text{An ontology\_term object}
  \item \texttt{name} \quad \text{The name of the slot to access}
\end{itemize}

Value

Slot value

Examples

\[
\text{\#\# Not run:}
\quad \text{OL = ontology\_list('STATO:0000555')}
\quad \text{OL\$terms}
\]

\[
\text{\#\# End(Not run)}
\]

\$\text{ontology\_term\_method}

\textit{Get/set ontology\_term slots}

Description

Dollar syntax can be used to as a shortcut for getting values for ontology\_term objects.

Usage

\[
\text{\#\# S4 method for signature 'ontology\_term'}
\]

\[x$name\]

Arguments

\begin{itemize}
  \item \texttt{x} \quad \text{An ontology\_term object}
  \item \texttt{name} \quad \text{The name of the slot to access}
\end{itemize}
### Description

Dollar syntax can be used to as a shortcut for getting/setting input parameter and output values for struct objects.

### Usage

```r
## S4 method for signature 'struct_class'

x$name
```

### Arguments

- **x**: An object derived from `struct_class`
- **name**: The name of the slot to access

### Value

Parameter/output value

### Examples

```r
M = example_model()
M$value_1 = 10
M$value_1 # 10
```
$<-\text{struct\_class\_method}$

$\text{Get/set parameter or output values}$

**Description**

Dollar syntax can be used as a shortcut for getting/setting input parameter and output values for struct objects.

**Usage**

```r
## S4 replacement method for signature 'struct\_class'
\$name \text{<-} \text{value}
```

**Arguments**

- **x** An object derived from struct\_class
- **name** The name of the slot to access
- **value** The value to assign

**Value**

Parameter/output value

**Examples**

```r
M = example\_model()
M\$value\_1 = 10
M\$value\_1 \# 10
```
Index

*, iterator, model\_OR\_iterator-method (run), 49
+, model, model-method (model\_seq), 30
+, model, model\_seq-method (model\_seq), 30
+.DollarNames, DatasetExperiment-method (.DollarNames.\textbackslash struct\_class), 3
.DollarNames, chart-method (.DollarNames.\textbackslash struct\_class), 3
.DollarNames, iterator-method (.DollarNames.\textbackslash struct\_class), 3
.DollarNames, metric-method (.DollarNames.\textbackslash struct\_class), 3
.DollarNames, model-method (.DollarNames.\textbackslash struct\_class), 3
.DollarNames, optimiser-method (.DollarNames.\textbackslash struct\_class), 3
.DollarNames, preprocess-method (.DollarNames.\textbackslash struct\_class), 3
.DollarNames, resampler-method (.DollarNames.\textbackslash struct\_class), 3
.DollarNames, struct\_class-method (.DollarNames.\textbackslash struct\_class), 3
.DollarNames.\textbackslash struct\_class (\textbackslash struct\_class-class), 57
\[, iterator, ANY, ANY, ANY-method (run), 49
\[, model\_seq, ANY, ANY, ANY-method (model\_seq), 30
\[, ontology\_list, ANY, ANY, ANY-method (ontology), 34
\<-, iterator, ANY, ANY, ANY-method (run), 49
\<-, model\_seq, ANY, ANY, ANY-method (model\_seq), 30
\<-, ontology\_list, ANY, ANY, ANY-method (ontology), 34
$.DatasetExperiment-method (DatasetExperiment). 13
$.ontology\_list-method. 60
$.ontology\_term-method. 60
$.struct\_class-method. 61
$\<-, struct\_class-method. 62
$\<-, DatasetExperiment-method (DatasetExperiment). 13
as.code, 5
as.code, iterator-method (as.code). 5
as.code, model\_seq-method (as.code). 5
as.code, struct\_class-method (as.code). 5
as.DatasetExperiment. 6
as.DatasetExperiment, SummarizedExperiment-method, 7
as.SummarizedExperiment. 7
as.SummarizedExperiment, DatasetExperiment-method. 8
as.data\_frame. 8
c, ontology\_list-method. 9
calculate, 9
calculate, metric-method (calculate). 9
calculate, test\_metric-method (test\_metric-class). 59
chart, 10
chart_names, 11
chart_names, struct_class-method
  (chart_names), 11
chart_plot, 12
chart_plot, chart, ANY-method
  (chart_plot), 12
chart_plot, example_chart, example_model-method
  (example_chart), 18
citations, 13
citations, struct_class-method
  (citations), 13
DatasetExperiment, 13
entity, 15
dataset, entity (max_length), 24
dataset, entity_state, 15
dataset, enum, 16, 17
dataset, enum_state, 17
evaluate, (run), 49
evaluate, iterator, metric-method (run), 49
dataset, example_chart, 18
dataset, example_iterator-class
  (example_iterator-class), 19
dataset, example_iterator-class
  (example_iterator-class), 19
dataset, example_model, 19
dataset, export_xlsx, 20
dataset, export_xlsx, DatasetExperiment-method
  (export_xlsx), 20
iris_DatasetExperiment, 21
dataset, is_output, 22
dataset, is_output, struct_class-method
  (is_output), 22
is_output, struct_class-method
  (is_output), 22
is_output, struct_class-method
  (is_output), 22
iterator, (run), 49
length, model_seq-method (model_seq), 30
length, ontology_list-method (ontology), 34
libraries, 23
libraries, struct_class-method
  (libraries), 23
max_length, 24
max_length, entity-method (max_length), 24
max_length<- (calculate), 9
max_length<-, entity-method
  (max_length), 24
metric (calculate), 9
model, 25
model_apply, 28
model_apply, model, DatasetExperiment-method
  (model), 25
model_apply, model_seq, DatasetExperiment-method
  (model_seq), 30
model_predict, 29
model_predict, example_model, DatasetExperiment-method
  (example_model), 19
model_predict, model, DatasetExperiment-method
  (model), 25
model_predict, model_seq, DatasetExperiment-method
  (model_seq), 30
model_reverse, 29
model_reverse, model, DatasetExperiment-method
  (model), 25
model_reverse, preprocess, DatasetExperiment-method
  (preprocess), 46
model_seq, 30
model_train, 32
model_train, example_model, DatasetExperiment-method
  (example_model), 19
model_train, model, DatasetExperiment-method
  (model), 25
model_train, model_seq, DatasetExperiment-method
  (model_seq), 30
models, 28
models, iterator-method (run), 49
models, model_seq-method (model_seq), 30
models<- (models), 28
models<-, iterator, model_OR_iterator-method
  (run), 49
models<-, model_seq, list-method
  (model_seq), 30
new_struct, 33
ontology, 34
ontology, struct_class-method
  (ontology), 34
ontology_list (ontology), 34
ontology_term (ontology), 34
optimiser, 36
output_ids, 36
output_ids, struct_class-method
(output_ids), 36
output_list, 37
output_list, struct_class-method
(output_list), 37
output_list<- (output_list), 37
output_list<-, struct_class, list-method
(output_list), 37
output_name, 38
output_name, struct_class, character-method
(output_name), 38
output_obj, 38
output_obj, struct_class, character-method
(output_obj), 38
output_obj<- (output_obj), 38
output_obj<-, struct_class, character-method
(output_obj), 38
output_value, 39
output_value, struct_class, character-method
(output_value), 39
output_value<- (output_value), 39
output_value<-, struct_class, character-method
(output_value), 39

param_ids, 40
param_ids, struct_class-method
(param_ids), 40
param_list, 41
param_list, struct_class-method
(param_list), 41
param_list<- (param_list), 41
param_list<-, struct_class, list-method
(param_list), 41
param_name, 42
param_name, struct_class, character-method
(param_name), 42
param_obj, 43
param_obj, struct_class, character-method
(param_obj), 43
param_obj<- (param_obj), 43
param_obj<-, struct_class, character-method
(param_obj), 43
param_value, 44
param_value, struct_class, character-method
(param_value), 44
param_value<- (param_value), 44
param_value<-, struct_class, character-method
(param_value), 44
predicted, 45
predicted, model-method (model), 25
predicted, model_seq-method (model_seq), 30
predicted_name, 45
predicted_name, model-method (model), 25
predicted_name<- (predicted_name), 45
predicted_name<-, model, character-method
(model), 25
preprocess, 46
resampler, 47
result, 47
result, iterator-method (run), 49
result_name, 48
result_name, iterator-method (run), 49
result_name<- (result_name), 48
result_name<-, iterator, character-method
(run), 49
run, 49
run, example_iterator, DatasetExperiment, metric-method
(example_iterator-class), 19
run, iterator, DatasetExperiment, metric-method
(run), 49
seq_in, 51
seq_in, model-method (model), 25
seq_in<-(seq_in), 51
seq_in<-, model, character-method
(model), 25
set_obj_method, 52
set_obj_show, 53
set_struct_obj, 54
stato, 15, 18
stato(stato_id), 54
stato_definition(stato_id), 54
stato_definition, stato-method
(stato_id), 54
stato_id, 54
stato_id, stato-method(stato_id), 54
stato_name(stato_id), 54
stato_name, stato-method(stato_id), 54
stato_summary(stato_id), 54
stato_summary, stato-method(stato_id), 54
struct, 56
struct, struct_class, 57
struct_class, 57
struct_template, 58
test_metric (test_metric-class), 59
  test_metric-class, 59

  value (calculate), 9
  value, entity-method (max_length), 24
  value, metric-method (calculate), 9
  value<- (calculate), 9
  value<-, entity-method (max_length), 24
  value<-, enum-method (enum), 16
  value<-, metric-method (calculate), 9