

Package ‘arenar’

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Title Arena for the Exploration and Comparison of any ML Models

Version 0.2.0

Description Generates data for challenging machine learning models in 'Arena' <<https://arena.drwhy.ai>> - an interactive web application. You can start the server with XAI (Explainable Artificial Intelligence) plots to be generated on-demand or precalculate and auto-upload data file beside shareable 'Arena' URL.

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Encoding UTF-8

LazyData true

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Imports ingredients, iBreakDown, gistr, jsonlite, plumber, parallel, utils, stats, methods, auditor, DALEX (>= 1.3.0), fairmodels, graphics

Suggests testthat, knitr, rmarkdown, dplyr, pkgdown, covr, ranger

VignetteBuilder knitr

URL <https://arenar.drwhy.ai>, <https://github.com/ModelOriented/ArenaR>

BugReports <https://github.com/ModelOriented/ArenaR/issues>

NeedsCompilation no

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 calculate_subsets_performance

Internal function for calculating data for funnel plot

Description

This is modified version of DALEXtra::funnel_measure

Usage

```
calculate_subsets_performance(
  explainer,
  score_functions = list(),
  nbins = 5,
  cutoff = 0.01,
  cutoff_name = "Other",
  factor_conversion_threshold = 7
)
```

Arguments

explainer	Explainer created using DALEX::explain
score_functions	Named list of functions named score_* from auditor package
nbins	Number of qunatiles (partition points) for numeric columns. In case when more than one qunatile have the same value, there will be less partition points.
cutoff	Threshold for categorical data. Entries less frequent than specified value will be merged into one category.
cutoff_name	Name for new category that arised after merging entries less frequent than cutoff
factor_conversion_threshold	Numeric columns with lower number of unique values than value of this parameter will be treated as factors

Value

Data frame with columns

- Variable Name of splited variable
- Label Label for variable's values subset

and one column for each score function with returned score

create_arena	<i>Creates arena object</i>
--------------	-----------------------------

Description

Creates object with class `arena_live` or `arena_static` depending on the first argument. This method is always first in `arenar` workflow and you should specify all plots' parameters there.

Usage

```
create_arena(
  live = FALSE,
  N = 500,
  fi_N = NULL,
  fi_B = 10,
  grid_points = 101,
  shap_B = 10,
  funnel_nbins = 5,
  funnel_cutoff = 0.01,
  funnel_factor_threshold = 7,
  fairness_cutoffs = seq(0.05, 0.95, 0.05),
  max_points_number = 150,
  distribution_bins = seq(5, 40, 5),
  enable_attributes = TRUE,
  enable_custom_params = TRUE,
  cl = NULL
)
```

Arguments

<code>live</code>	Defines if arena should start live server or generate static json
<code>N</code>	number of observations used to calculate dependence profiles
<code>fi_N</code>	number of observations used in feature importance
<code>fi_B</code>	Number of permutation rounds to perform each variable in feature importance
<code>grid_points</code>	number of points for profile
<code>shap_B</code>	Numer of random paths in SHAP
<code>funnel_nbins</code>	Number of partitions for numeric columns for funnel plot
<code>funnel_cutoff</code>	Threshold for categorical data. Entries less frequent than specified value will be merged into one category in funnel plot.
<code>funnel_factor_threshold</code>	Numeric columns with lower number of unique values than value of this parameter will be treated as factors in funnel plot.
<code>fairness_cutoffs</code>	vector of available cutoff levels for fairness panel

max_points_number	maximum size of sample to plot scatter plots in variable against another panel
distribution_bins	vector of available bins count for histogram
enable_attributes	Switch for generating attributes of observations and variables. It is required for custom params. Attributes can increase size of static Arena.
enable_custom_params	Switch to allowing user to modify observations and generate plots for them.
cl	Cluster used to run parallel computations (Do not work in live Arena)

Value

Empty arena_static or arena_live class object.

arena_static:

- explainer List of used explainers
- observations_batches List of data frames added as observations
- params Plots' parameters
- plots_data List of generated data for plots

arena_live:

- explainer List of used explainers
- observations_batches List of data frames added as observations
- params Plots' parameters
- timestamp Timestamp of last modification

Examples

```
library("DALEX")
library("arenar")
library("dplyr", quietly=TRUE, warn.conflicts = FALSE)
# create a model
model <- glm(m2.price ~ ., data=apartments)
# create a DALEX explainer
explainer <- DALEX::explain(model, data=apartments, y=apartments$m2.price)
# prepare observations to be explained
observations <- apartments[1:3, ]
# rownames are used as labels for each observation
rownames(observations) <- paste0(observations$construction.year, "-", observations$surface, "m2")
# generate static arena for one model and 3 observations
arena <- create_arena(live=FALSE) %>% push_model(explainer) %>% push_observations(observations)
print(arena)
if (interactive()) upload_arena(arena)
```

get_accumulated_dependence	<i>Internal function for calculating Accumulated Dependence</i>
----------------------------	---

Description

Internal function for calculating Accumulated Dependence

Usage

get_accumulated_dependence(explainer, variable, params)

Arguments

explainer	Explainer created using DALEX::explain
variable	Name of variable
params	Params from arena object

Value

Plot data in Arena’s format

get_attributes	<i>Returns attributes for all params</i>
----------------	--

Description

When param_type is not NULL, then function returns list of objects. Each object represents one of available attribute for specified param type. Field name is attribute name and field values is mapped list of available params to list of value of this attribute for that param. When param_type is NULL, then function returns list with keys for each param type and values are lists described above.

Usage

get_attributes(arena, param_type = NULL)

Arguments

arena	live or static arena object
param_type	Type of param. One of • model • variable • dataset • observation

Value

List of attributes or named list of lists of attributes for each param type.

get_break_down	<i>Internal function for calculating Break Down</i>
----------------	---

Description

Internal function for calculating Break Down

Usage

```
get_break_down(explainer, observation, params)
```

Arguments

explainer	Explainer created using DALEX::explain
observation	One row data frame observation
params	Params from arena object

Value

Plot data in Arena's format

get_ceteris_paribus	<i>Internal function for calculating Ceteris Paribus</i>
---------------------	--

Description

Internal function for calculating Ceteris Paribus

Usage

```
get_ceteris_paribus(explainer, observation, variable, params)
```

Arguments

explainer	Explainer created using DALEX::explain
observation	One row data frame observation
variable	Name of variable
params	Params from arena object

Value

Plot data in Arena's format

get_datasets_list	<i>Generates list of datasets' labels</i>
-------------------	---

Description

Generates list of datasets' labels

Usage

get_datasets_list(arena)

Arguments

arena live or static arena object

Value

list of datasets' labels

get_dataset_attributes	<i>Generates list with attributes of a dataset</i>
------------------------	--

Description

Generates list with attributes of a dataset

Usage

get_dataset_attributes(arena, dataset)

Arguments

arena live or static arena object

dataset List with following elements

- dataset Data frame
- target Name of one column from data frame that is used as target variable
- label Label for dataset to be displayed in Arena
- variables vector of column names from data frame without target

Value

simple list with attributes of given dataset

get_dataset_plots	<i>Internal function for calculating exploratory data analysis plots</i>
-------------------	--

Description

Function runs all plot generating methods for given dataset

Usage

```
get_dataset_plots(dataset, params)
```

Arguments

dataset	List with following elements • dataset Data frame • target Name of one column from data frame that is used as target variable • label Label for dataset to be displayed in Arena • variables vector of column names from data frame without target
params	Params from arena object

Value

list of generated plots' data

get_fairness	<i>Internal function for calculating fairness</i>
--------------	---

Description

Internal function for calculating fairness

Usage

```
get_fairness(explainer, variable, params)
```

Arguments

explainer	Explainer created using DALEX::explain
variable	Name of variable
params	Params from arena object

Value

Plot data in Arena's format

get_feature_importance	<i>Internal function for calculating feature importance</i>
------------------------	---

Description

Internal function for calculating feature importance

Usage

get_feature_importance(explainer, params)

Arguments

explainer	Explainer created using DALEX::explain
params	Params from arena object

Value

Plot data in Arena's format

get_funnel_measure	<i>Internal function for calculating funnel measure</i>
--------------------	---

Description

Internal function for calculating funnel measure

Usage

get_funnel_measure(explainer, params)

Arguments

explainer	Explainer created using DALEX::explain
params	Params from arena object

Value

Plot data in Arena's format

get_global_plots	<i>Internal function for calculating global plots</i>
------------------	---

Description

Function runs all plot generating methods for given explainer

Usage

```
get_global_plots(explainer, params)
```

Arguments

explainer	Explainer created using DALEX::explain
params	Params from arena object

Value

list of generated plots' data

get_json_structure	<i>Prepare object ready to change into json</i>
--------------------	---

Description

Function converts object with class arena_live or arena_static to object with structure accepted by Arena. See [list of schemas](#).

Usage

```
get_json_structure(arena)
```

Arguments

arena	live or static arena object
-------	-----------------------------

Value

Object for direct conversion into json

get_local_plots	<i>Internal function for calculating local plots for all observations</i>
-----------------	---

Description

Function runs all plot generating methods for given observations

Usage

```
get_local_plots(explainer, observations, params)
```

Arguments

explainer	Explainer created using DALEX::explain
observations	Data frame of observations
params	Params from arena object

Value

list of generated plots' data

get_message_output	<i>Internal function for returning message as plot data</i>
--------------------	---

Description

This method modify existing plot's data in Arena's format to show message instead of chart.

Usage

```
get_message_output(output, type, msg)
```

Arguments

output	existing plot data to be overwritten
type	type of message "info" or "error"
msg	message to be displayed

Value

Plot data in Arena's format

get_metrics	<i>Internal function for calculating model performance metrics</i>
-------------	--

Description

Internal function for calculating model performance metrics

Usage

```
get_metrics(explainer, params)
```

Arguments

explainer	Explainer created using DALEX::explain
params	Params from arena object

Value

Plot data in Arena's format

get_model_attributes	<i>Generates list with attributes of a model</i>
----------------------	--

Description

Generates list with attributes of a model

Usage

```
get_model_attributes(arena, explainer)
```

Arguments

arena	live or static arena object
explainer	Explainer created using DALEX::explain

Value

simple list with attributes of given model

`get_observations_list` *Generates list of rownames of each observation from each batch*

Description

Generates list of rownames of each observation from each batch

Usage

```
get_observations_list(arena)
```

Arguments

arena live or static arena object

Value

list of observations' names

`get_observation_attributes`
Generates list with attributes of an observation

Description

Generates list with attributes of an observation

Usage

```
get_observation_attributes(arena, observation)
```

Arguments

arena live or static arena object
observation One row data frame observation

Value

simple list with attributes of given observation

`get_partial_dependence`*Internal function for calculating Partial Dependence*

Description

Internal function for calculating Partial Dependence

Usage

```
get_partial_dependence(explainer, variable, params)
```

Arguments

<code>explainer</code>	Explainer created using DALEX::explain
<code>variable</code>	Name of variable
<code>params</code>	Params from arena object

Value

Plot data in Arena's format

`get_rec`*Internal function for calculating regression error characteristic*

Description

Internal function for calculating regression error characteristic

Usage

```
get_rec(explainer, params)
```

Arguments

<code>explainer</code>	Explainer created using DALEX::explain
<code>params</code>	Params from arena object

Value

Plot data in Arena's format

get_roc	<i>Internal function for calculating receiver operating curve</i>
---------	---

Description

Internal function for calculating receiver operating curve

Usage

```
get_roc(explainer, params)
```

Arguments

explainer	Explainer created using DALEX::explain
params	Params from arena object

Value

Plot data in Arena's format

get_shap_values	<i>Internal function for calculating Shapley Values</i>
-----------------	---

Description

Internal function for calculating Shapley Values

Usage

```
get_shap_values(explainer, observation, params)
```

Arguments

explainer	Explainer created using DALEX::explain
observation	One row data frame observation to calculate Shapley Values
params	Params from arena object

Value

Plot data in Arena's format

`get_subsets_performance`*Internal function for calculating subset performance*

Description

Internal function for calculating subset performance

Usage

```
get_subsets_performance(explainer, params)
```

Arguments

<code>explainer</code>	Explainer created using DALEX::explain
<code>params</code>	Params from arena object

Value

Plot data in Arena's format

<code>get_variables_list</code>	<i>Generates list of unique variables(without target) from each explainer and dataset</i>
---------------------------------	---

Description

Generates list of unique variables(without target) from each explainer and dataset

Usage

```
get_variables_list(arena)
```

Arguments

<code>arena</code>	live or static arena object
--------------------	-----------------------------

Value

list of variables' names

get_variable_against_another
<i>Internal function for variable against another plot</i>

Description

Internal function for variable against another plot

Usage

get_variable_against_another(dataset, variable, params)

Arguments

dataset	List with following elements - dataset Data frame - target Name of one column from data frame that is used as target variable - label Label for dataset to be displayed in Arena - variables vector of column names from data frame without target
variable	Name of primary variable
params	Params from arena object

Value

Plot data in Arena’s format

get_variable_attributes
<i>Generates list with attributes of an variable</i>

Description

Generates list with attributes of an variable

Usage

get_variable_attributes(arena, variable)

Arguments

arena	live or static arena object
variable	Name of variable

Value

simple list with attributes of given variable

`get_variable_distribution`*Internal function for variable distribution*

Description

Internal function for variable distribution

Usage

```
get_variable_distribution(dataset, variable, params)
```

Arguments

dataset	List with following elements • dataset Data frame • target Name of one column from data frame that is used as target variable • label Label for dataset to be displayed in Arena • variables vector of column names from data frame without target
variable	Name of variable
params	Params from arena object

Value

Plot data in Arena's format

`print.arena_live` *Prints live arena summary*

Description

Prints live arena summary

Usage

```
## S3 method for class 'arena_live'  
print(x, ...)
```

Arguments

x	arena_live object
...	other parameters

Value

None

Examples

```

library("DALEX")
library("arenar")
library("dplyr", quietly=TRUE, warn.conflicts = FALSE)
# create a model
model <- glm(m2.price ~ ., data=apartments)
# create a DALEX explainer
explainer <- DALEX::explain(model, data=apartments, y=apartments$m2.price)
# prepare observations to be explained
observations <- apartments[1:30, ]
# rownames are used as labels for each observation
rownames(observations) <- paste0(observations$construction.year, "-", observations$surface, "m2")
# generate live arena for one model and 30 observations
arena <- create_arena(live=TRUE) %>% push_model(explainer) %>% push_observations(observations)
# print summary
print(arena)

```

print.arena_static	<i>Prints static arena summary</i>
--------------------	------------------------------------

Description

Prints static arena summary

Usage

```

## S3 method for class 'arena_static'
print(x, ...)

```

Arguments

x	arena_static object
...	other parameters

Value

None

Examples

```
library("DALEX")
library("arenar")
library("dplyr", quietly=TRUE, warn.conflicts = FALSE)
# create a model
model <- glm(m2.price ~ ., data=apartments)
# create a DALEX explainer
explainer <- DALEX::explain(model, data=apartments, y=apartments$m2.price)
# prepare observations to be explained
observations <- apartments[1:3, ]
# rownames are used as labels for each observation
rownames(observations) <- paste0(observations$construction.year, "-", observations$surface, "m2")
# generate static arena for one model and 3 observations
arena <- create_arena(live=FALSE) %>% push_model(explainer) %>% push_observations(observations)
# print summary
print(arena)
```

push_dataset	<i>Adds new datasets to Arena</i>
--------------	-----------------------------------

Description

Adds data frame to create exploratory data analysis plots

Usage

```
push_dataset(arena, dataset, target, label)
```

Arguments

arena	live or static arena object
dataset	data frame used for EDA plots
target	name of target variable
label	label of dataset

Value

Updated arena object

Examples

```
library("DALEX")
library("arenar")
library("dplyr", quietly=TRUE, warn.conflicts = FALSE)
# create live arena with only one dataset
apartments <- DALEX::apartments
arena <- create_arena(live=TRUE) %>% push_dataset(apartments, "m2.price", "apartment")
print(arena)
```

```
# add another dataset
HR <- DALEX::HR
arena <- arena %>% push_dataset(HR, "status", "HR")
print(arena)
```

push_model

Adds model to arena

Description

If arena is static it will start calculations for all already pushed observations and global plots. If arena is live, then plots will be calculated on demand, after calling arena_run.

Usage

```
push_model(arena, explainer)
```

Arguments

arena	live or static arena object
explainer	Explainer created using DALEX::explain

Value

Updated arena object

Examples

```
library("DALEX")
library("arenar")
library("dplyr", quietly=TRUE, warn.conflicts = FALSE)
# create first model
model1 <- glm(m2.price ~ ., data=apartments, family=gaussian)
# create a DALEX explainer
explainer1 <- DALEX::explain(model1, data=apartments, y=apartments$m2.price, label="GLM gaussian")
# create live arena with only one model
arena <- create_arena(live=TRUE) %>% push_model(explainer1)
print(arena)
# create and add next model
model2 <- glm(m2.price ~ ., data=apartments, family=Gamma)
explainer2 <- DALEX::explain(model2, data=apartments, y=apartments$m2.price, label="GLM gamma")
arena <- arena %>% push_model(explainer2)
print(arena)
```

push_observations	<i>Adds new observations to arena</i>
-------------------	---------------------------------------

Description

If arena is static it will start calculations for all already pushed models. If arena is live, then plots will be calculated on demand, after calling arena_run.

Usage

```
push_observations(arena, observations)
```

Arguments

arena	live or static arena object
observations	data frame of new observations

Value

Updated arena object

run_server	<i>Run server providing data for live Arena</i>
------------	---

Description

By default function opens browser with new arena session. Appending data to already existing session is also possible using argument append_data

Usage

```
run_server(  
  arena,  
  port = 8181,  
  host = "127.0.0.1",  
  open_browser = TRUE,  
  append_data = FALSE,  
  arena_url = "https://arena.drwhy.ai/"  
)
```

Arguments

arena	Live arena object
port	server port
host	server ip address (hostnames do not work yet)
open_browser	Whether to open browser with new session
append_data	Whether to append data to already existing session
arena_url	URL of Arena dashboard instance

Value

not modified arena object

Examples

```
library("DALEX")
library("arenar")
library("dplyr", quietly=TRUE, warn.conflicts = FALSE)
# create a model
model <- glm(m2.price ~ ., data=apartments)
# create a DALEX explainer
explainer <- DALEX::explain(model, data=apartments, y=apartments$m2.price)
# generate live arena for one model and all data as observations
arena <- create_arena(live=TRUE) %>% push_model(explainer) %>% push_observations(apartments)
# run the server
if (interactive()) run_server(arena, port=1234)
```

save_arena	<i>Save generated json file from static arena</i>
------------	---

Description

Save generated json file from static arena

Usage

```
save_arena(arena, filename = "data.json", pretty = FALSE)
```

Arguments

arena	Static arena object
filename	Name of output file
pretty	whether to generate pretty and easier to debug JSON

Value

not modified arena object

`split_multiclass_explainer`*Splits multiclass explainer into multiple classification explainers*

Description

Splits multiclass explainer into multiple classification explainers

Usage

```
split_multiclass_explainer(explainer)
```

Arguments

explainer Multiclass explainer created using DALEX::explain

Value

list of explainers

`truncate_vector`*Internal function for pretty truncationg params list*

Description

Internal function for pretty truncationg params list

Usage

```
truncate_vector(vec, size = 6)
```

Arguments

vec vector to be truncated

size elements with index greater than size will be truncated

Value

string with collapsed and truncated input vector

upload_arena	<i>Upload generated json file from static arena</i>
--------------	---

Description

By default function opens browser with new arena session. Appending data to already existing session is also possible using argument append_data

Usage

```
upload_arena(  
    arena,  
    open_browser = TRUE,  
    append_data = FALSE,  
    arena_url = "https://arena.drwhy.ai/",  
    pretty = FALSE  
)
```

Arguments

arena	Static arena object
open_browser	Whether to open browser with new session
append_data	Whether to append data to already existing session
arena_url	URL of Arena dashboard instance
pretty	whether to generate pretty and easier to debug JSON

Value

not modified arena object

validate_new_dataset	<i>Checks if it is safe do add new dataset to the arena object</i>
----------------------	--

Description

Checks if it is safe do add new dataset to the arena object

Usage

```
validate_new_dataset(arena, dataset, target, label)
```

Arguments

arena	live or static arena object
dataset	data frame for data analysis
target	name of target variable
label	name of dataset

Value

None

validate_new_model	<i>Checks if it is safe do add a new model to the arena object</i>
--------------------	--

Description

Function checks if explainer's label is not already used call stop if there is at least one conflict.

Usage

```
validate_new_model(arena, explainer)
```

Arguments

arena	live or static arena object
explainer	Explainer created using DALEX::explain

Value

None

validate_new_observations	<i>Checks if it is safe do add new observations to the arena object</i>
---------------------------	---

Description

Function checks if rownames are not already used and call stop if there is at least one conflict.

Usage

```
validate_new_observations(arena, observations)
```

Arguments

arena	live or static arena object
observations	data frame of new observations

Value

None

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