Package ‘drifter’

October 13, 2022

Title  Concept Drift and Concept Shift Detection for Predictive Models

Version  0.2.1

Description  Concept drift refers to the change in the data distribution or in the relationships between variables over time. 'drifter' calculates distances between variable distributions or variable relations and identifies both types of drift. Key functions are: calculate_covariate_drift() checks distance between corresponding variables in two datasets, calculate_residuals_drift() checks distance between residual distributions for two models, calculate_model_drift() checks distance between partial dependency profiles for two models, check_drift() executes all checks against drift. 'drifter' is a part of the 'DrWhy.AI' universe (Biecek 2018) <arXiv:1806.08915>.

Depends  R (>= 3.1)

License  GPL

Encoding  UTF-8

LazyData  true

Imports  DALEX, dplyr, tidyR, ingredients

Suggests  testthat, ranger

RoxygenNote  6.1.1

URL  https://ModelOriented.github.io/drifter/

BugReports  https://github.com/ModelOriented/drifter/issues

NeedsCompilation  no

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**R topics documented:**

- `calculate_covariate_drift` ........................................... 2
- `calculate_distance` ....................................................... 3
- `calculate_model_drift` .................................................... 3
- `calculate_residuals_drift` ............................................. 5
- `check_drift` ................................................................. 6
- `compare_two_profiles` ................................................... 7
- `print.all_drifter_checks` .............................................. 8
- `print.covariate_drift` ............................................... 9
- `print.model_drift` ....................................................... 9

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**calculate_covariate_drift**

*Calculate Covariate Drift for two data frames*

**Description**

Here covariate drift is defined as Non-Intersection Distance between two distributions. More formally, \( d(P,Q) = 1 - \sum_i \min(P_i, Q_i) \). The larger the distance the more different are two distributions.

**Usage**

```r
calculate_covariate_drift(data_old, data_new, bins = 20)
```

**Arguments**

- `data_old` : data frame with ‘old’ data
- `data_new` : data frame with ‘new’ data
- `bins` : continuous variables are discretized to ‘bins’ intervals of equal sizes

**Value**

an object of a class ‘covariate_drift’ (data.frame) with Non-Intersection Distances

**Examples**

```r
library("DALEX")
# here we do not have any drift
d <- calculate_covariate_drift(apartments, apartments_test)
d
# here we do have drift
d <- calculate_covariate_drift(dragons, dragons_test)
d
```
calculate_distance  Calculate Non-Intersection Distance

Description

Calculate Non-Intersection Distance

Usage

calculate_distance(variable_old, variable_new, bins = 20)

Arguments

variable_old  variable from ‘old’ data
variable_new  variable from ‘new’ data
bins  continuous variables are discretized to ‘bins’ intervals of equal size

Value

Non-Intersection Distance

Examples

calculate_distance(rnorm(1000), rnorm(1000))
calculate_distance(rnorm(1000), runif(1000))

calculate_model_drift  Calculate Model Drift for comparison of models trained on new/old data

Description

This function calculates differences between PDP curves calculated for new/old models

Usage

calculate_model_drift(model_old, model_new, data_new, y_new,
  predict_function = predict, max_obs = 100, scale = sd(y_new, na.rm = TRUE))
**Arguments**

- `model_old` model created on historical / 'old' data
- `model_new` model created on current / 'new' data
- `data_new` data frame with current / 'new' data
- `y_new` true values of target variable for current / 'new' data
- `predict_function` function that takes two arguments: model and new data and returns numeric vector with predictions, by default it's 'predict'
- `max_obs` if negative, then all observations are used for calculation of PDP, is positive, then only 'max_obs' are used for calculation of PDP
- `scale` scale parameter for calculation of scaled drift

**Value**

an object of a class 'model_drift' (data.frame) with distances calculated based on Partial Dependency Plots

**Examples**

```r
library("DALEX")
model_old <- lm(m2.price ~ ., data = apartments)
model_new <- lm(m2.price ~ ., data = apartments_test[1:1000,])
calculate_model_drift(model_old, model_new,
                       apartments_test[1:1000,],
                       apartments_test[1:1000,]$m2.price)

library("ranger")
predict_function <- function(m, x, ...) predict(m, x, ...)$predictions
model_old <- ranger(m2.price ~ ., data = apartments)
model_new <- ranger(m2.price ~ ., data = apartments_test)
calculate_model_drift(model_old, model_new,
                       apartments_test,
                       apartments_test$m2.price,
                       predict_function = predict_function)

# here we compare model created on male data
# with model applied to female data
# there is interaction with age, and it is detected here
predict_function <- function(m, x, ...) predict(m, x, ..., probability=TRUE)$predictions[,1]
data_old = HR[HR$gender == "male", -1]
data_new = HR[HR$gender == "female", -1]
model_old <- ranger(status ~ ., data = data_old, probability=TRUE)
model_new <- ranger(status ~ ., data = data_new, probability=TRUE)
calculate_model_drift(model_old, model_new,
                       HR_test,
                       HR_test$status == "fired",
                       predict_function = predict_function)
```
# plot it
library("ingredients")
prof_old <- partial_dependency(model_old,
data = data_new[1:500,],
label = "model_old",
predict_function = predict_function,
grid_points = 101,
variable_splits = NULL)

prof_new <- partial_dependency(model_new,
data = data_new[1:500,],
label = "model_new",
predict_function = predict_function,
grid_points = 101,
variable_splits = NULL)

plot(prof_old, prof_new, color = "_label_")

---

calculate_residuals_drift

*Calculate Residual Drift for old model and new vs. old data*

**Description**

Calculate Residual Drift for old model and new vs. old data

**Usage**

calculate_residuals_drift(model_old, data_old, data_new, y_old, y_new,
predict_function = predict, bins = 20)

**Arguments**

- `model_old`: model created on historical / 'old' data
- `data_old`: data frame with historical / 'old' data
- `data_new`: data frame with current / 'new' data
- `y_old`: true values of target variable for historical / 'old' data
- `y_new`: true values of target variable for current / 'new' data
- `predict_function`: function that takes two arguments: model and new data and returns numeric vector with predictions, by default it's 'predict'
- `bins`: continuous variables are discretized to 'bins' intervals of equal sizes

**Value**

an object of a class 'covariate_drift' (data.frame) with Non-Intersection Distances calculated for residuals
check_drift

This function executes all tests for drift between two datasets / models

Examples

```r
library("DALEX")
model_old <- lm(m2.price ~ ., data = apartments)
model_new <- lm(m2.price ~ ., data = apartments_test[1:1000,])
calculate_model_drift(model_old, model_new,
apartments_test[1:1000,],
apartments_test[1:1000,]$m2.price)
library("ranger")
predict_function <- function(m,x,...) predict(m, x, ...)$predictions
model_old <- ranger(m2.price ~ ., data = apartments)
calculate_residuals_drift(model_old,
apartments_test[1:4000,], apartments_test[4001:8000,],
apartments_test$m2.price[1:4000], apartments_test$m2.price[4001:8000],
predict_function = predict_function)
calculate_residuals_drift(model_old,
apartments, apartments_test,
apartments$m2.price, apartments_test$m2.price,
predict_function = predict_function)
```

Description

Currently three checks are implemented, covariate drift, residual drift and model drift.

Usage

```r
check_drift(model_old, model_new, data_old, data_new, y_old, y_new,
predict_function = predict, max_obs = 100, bins = 20,
scale = sd(y_new, na.rm = TRUE))
```

Arguments

- `model_old`: model created on historical / 'old'data
- `model_new`: model created on current / 'new'data
- `data_old`: data frame with historical / 'old' data
- `data_new`: data frame with current / 'new' data
- `y_old`: true values of target variable for historical / 'old' data
- `y_new`: true values of target variable for current / 'new' data
- `predict_function`: function that takes two arguments: model and new data and returns numeric vector with predictions, by default it's 'predict'
**compare_two_profiles**

Calculates distance between two Ceteris Paribus Profiles

**Description**

This function calculates square root from mean square difference between Ceteris Paribus Profiles

**Usage**

```r
calculate_drift(cpprofile_old, cpprofile_new, variables, scale = 1)
```

**Arguments**

- `cpprofile_old`: Ceteris Paribus Profile for historical / 'old' model
- `cpprofile_new`: Ceteris Paribus Profile for current / 'new' model
- `variables`: variables for which drift should be calculated
- `scale`: scale parameter for calculation of scaled drift

**Value**

This function executes for its side effects, all checks are being printed on the screen. Additionally it returns list with particular checks.

**Examples**

```r
library("DALEX")
model_old <- lm(m2.price ~ ., data = apartments)
model_new <- lm(m2.price ~ ., data = apartments_test[1:1000,])
check_drift(model_old, model_new,
apartments, apartments_test,
apartments$m2.price, apartments_test$m2.price)

library("ranger")
predict_function <- function(m,x,...) predict(m, x, ...)$predictions
model_old <- ranger(m2.price ~ ., data = apartments)
model_new <- ranger(m2.price ~ ., data = apartments_test)
check_drift(model_old, model_new,
apartments, apartments_test,
apartments$m2.price, apartments_test$m2.price,
predict_function = predict_function)
```
Value

data frame with distances between Ceteris Paribus Profiles

print.all_drifter_checks

Print All Drifter Checks

Description

Print All Drifter Checks

Usage

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

Arguments

x an object of the class 'all_drifter_checks'
...
other arguments, currently ignored

Value

this function prints all drifter checks

Examples

library("DALEX")
model_old <- lm(m2.price ~ ., data = apartments)
model_new <- lm(m2.price ~ ., data = apartments_test[1:1000,])
check_drift(model_old, model_new,
            apartments, apartments_test,
            apartments$m2.price, apartments_test$m2.price)

library("ranger")
predict_function <- function(m,x,...) predict(m, x, ...)$predictions
model_old <- ranger(m2.price ~ ., data = apartments)
model_new <- ranger(m2.price ~ ., data = apartments_test)
check_drift(model_old, model_new,
            apartments, apartments_test,
            apartments$m2.price, apartments_test$m2.price,
predict_function = predict_function)
print.covariate_drift  

**Print Covariate Drift Data Frame**

**Description**

Print Covariate Drift Data Frame

**Usage**

```r
## S3 method for class 'covariate_drift'
print(x, max_length = 25, ...)
```

**Arguments**

- `x`: an object of the class ‘covariate_drift’
- `max_length`: length of the first column, by default 25
- `...`: other arguments, currently ignored

**Value**

this function prints a data frame with a nicer format

**Examples**

```r
library("DALEX")
# here we do not have any drift
d <- calculate_covariate_drift(apartments, apartments_test)
d
# here we do have drift
d <- calculate_covariate_drift(dragons, dragons_test)
d
```

print.model_drift  

**Print Model Drift Data Frame**

**Description**

Print Model Drift Data Frame

**Usage**

```r
## S3 method for class 'model_drift'
print(x, max_length = 25, ...)
```
print.model_drift

Arguments

x an object of the class 'model_drift'
max_length length of the first column, by default 25
... other arguments, currently ignored

Value

this function prints a data frame with a nicer format

Examples

library("DALEX")
model_old <- lm(m2.price ~ ., data = apartments)
model_new <- lm(m2.price ~ ., data = apartments_test[1:1000,])
calculate_model_drift(model_old, model_new,
apartments_test[1:1000,],
apartments_test[1:1000,]$m2.price)

library("ranger")
predict_function <- function(m,x,...) predict(m, x, ...)$predictions
model_old <- ranger(m2.price ~ ., data = apartments)
model_new <- ranger(m2.price ~ ., data = apartments_test)
calculate_model_drift(model_old, model_new,
apartments_test,
apartments_test$m2.price,
predict_function = predict_function)

# here we compare model created on male data
# with model applied to female data
# there is interaction with age, and it is detected here
predict_function <- function(m,x,...) predict(m, x, ..., probability=TRUE)$predictions[,1]
data_old = HR[HR$gender == "male", -1]
data_new = HR[HR$gender == "female", -1]
model_old <- ranger(status ~ ., data = data_old, probability=TRUE)
model_new <- ranger(status ~ ., data = data_new, probability=TRUE)
calculate_model_drift(model_old, model_new,
HR_test,
HR_test$status == "fired",
predict_function = predict_function)

# plot it
library("ingredients")
prof_old <- partial_dependency(model_old,
data = data_new[1:1000,],
label = "model_old",
predict_function = predict_function,
grid_points = 101,
variable_splits = NULL)
prof_new <- partial_dependency(model_new,
data = data_new[1:1000,],
label = "model_new",
predict_function = predict_function,
grid_points = 101,
variable_splits = NULL)

plot(prof_old, prof_new, color = "_label_")
Index

calculate_covariate_drift, 2
calculate_distance, 3
calculate_model_drift, 3
calculate_residuals_drift, 5
check_drift, 6
compare_two_profiles, 7
print.all_drifter_checks, 8
print.covariate_drift, 9
print.model_drift, 9