

Compare predictive models created in different languages with DALEX and friends

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Why R? 2019, Warsaw, 30 September 2019

About me

- Bachelor candidate in Data Science
- Interested in:
 - XAI
 - R and Python integration
- So far ripleyed once



**Faculty of Mathematics
and Information Science**

WARSAW UNIVERSITY OF TECHNOLOGY



MI² Data Lab



Hadley Wickham ✓

@hadleywickham

Obserwuj



W odpowiedzi do @xieyihui

@xieyihui we got ripleyed too :(

09:58 - 4 gru 2012

2 polubienia



2



2



Antonio Piccolboni @piccolbo · 4 gru 2012



W odpowiedzi do @hadleywickham

@hadleywickham @xieyihui We found thorough testing and submission to CRAN to be incompatible.



Antonio Piccolboni @piccolbo · 4 gru 2012



W odpowiedzi do @hadleywickham

@hadleywickham @xieyihui I think I got Ripleyed too. A confirmed bug with a three character fix closed just because he can. No appeal.



Agenda

1. Explaining Python models in R

- a) DALEX
- b) reticulate
- c) explain_scikitlearn

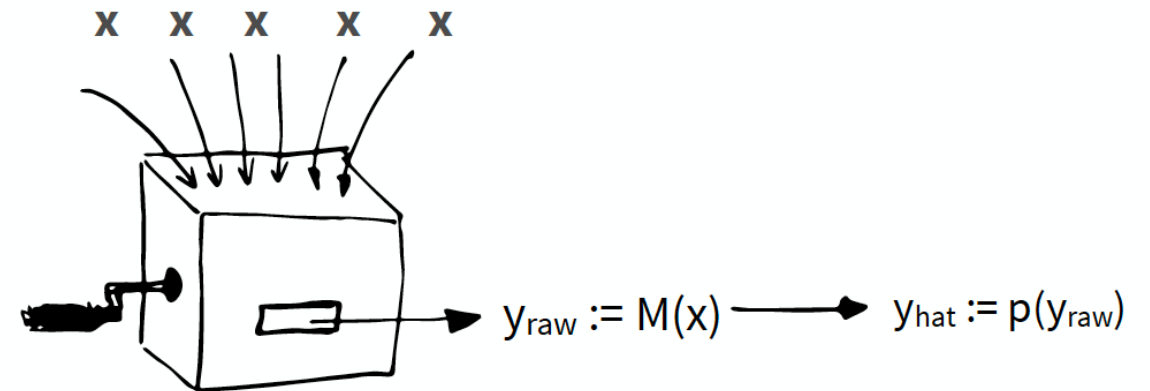
2. Comparison of models

- a) Common methods
- b) Funnel plot
- c) Performance audit
- d) Overall comparison
- e) Create your report!

What actually XAI is?

XAI

- Models are more and more sophisticated. They can have thousands of coefficients.
- In many applications we need to inspect how model treats our input.
- We need tools to estimate model parameters.



Why do we need to
integrate?

- To establish common ground between two, significantly different, environments
 - Compare models in a unified way
 - Use same tools for every model
 - Make benchmarks that will not be affected by runtime environment

DALEX - Descriptive mAchine Learning EXplanations

- Wrapper over a model. Core of DrWhy.ai universe.
- Helps to understand how complex models are working.
- Can work with any type of black-box models.



How to integrate?

Reticulate



- Lets us evoke Python commands from R code.
- Allows to use Python object as R one.
- Trivia – will not work if user name has non-ASCII signs

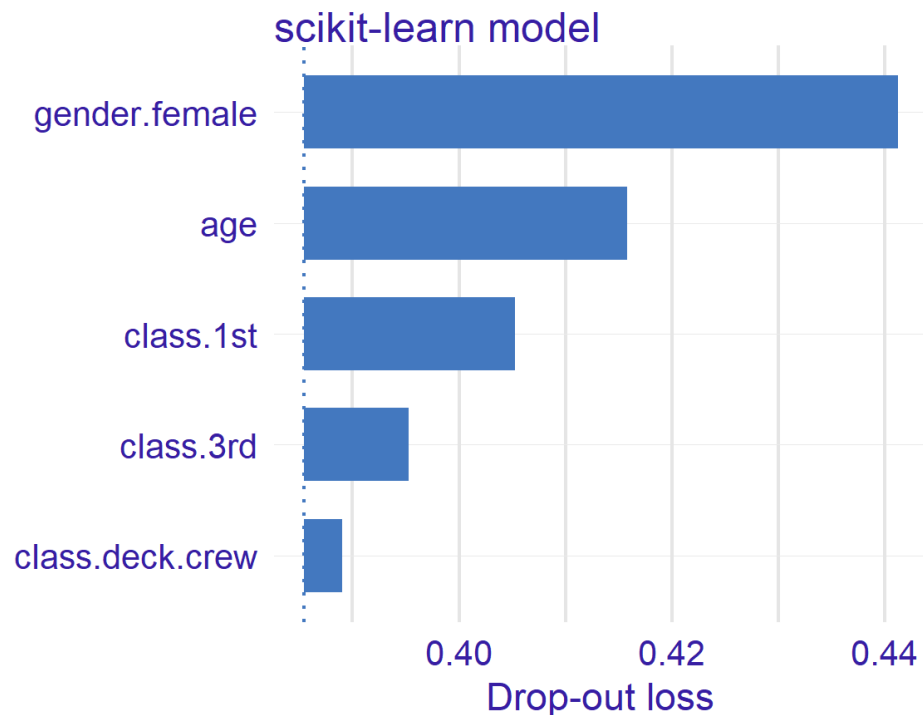
```
> library(reticulate)
> sys <- import("sys")
> sys$copyright
[1] "Copyright (c) 2001-2019 Python Software Foundation.\nAll Rights Reserved.\n\nCopyright (c) 2000 BeOpen.\ncom.\nAll Rights Reserved.\n\nCopyright (c) 1995-2001 Corporation for National Research Initiatives.\nAll Ri\nghts Reserved.\n\nCopyright (c) 1991-1995 Stichting Mathematisch Centrum, Amsterdam.\nAll Rights Reserved."
```

Explain!

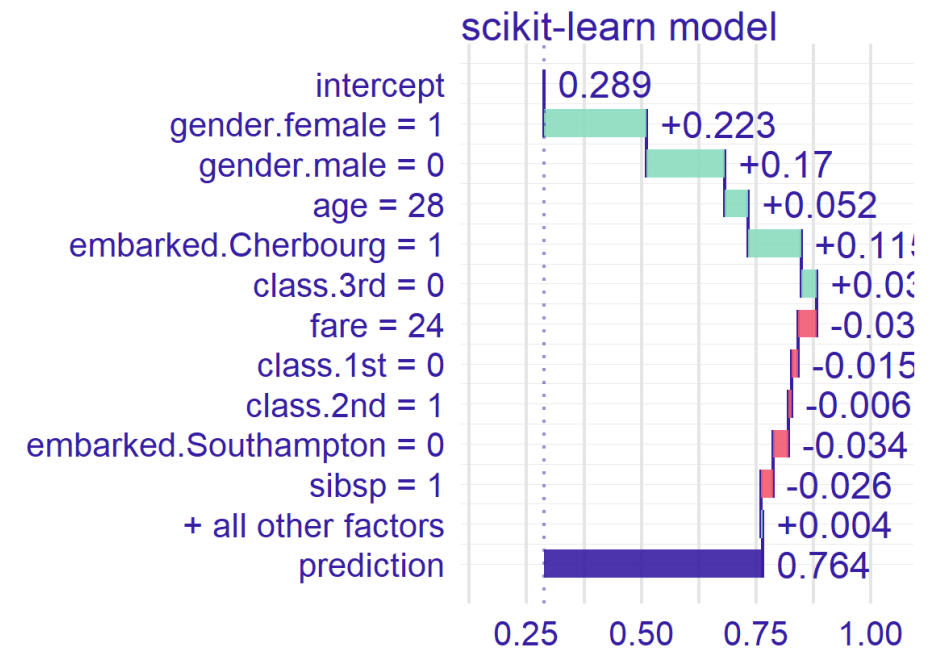
explain scikitlearn function

```
library(DALEXtra)
titanic_test <- read.csv(system.file("extdata", "titanic_test.csv", package = "DALEXtra"))
pk1_path <- system.file("extdata", "scikitlearn.pkl", package = "DALEXtra")
explainer <- explain_scikitlearn(path = pk1_path,
                                condaenv = "myenv",
                                data = titanic_test[,-18],
                                y = titanic_test[,18]
                                )
```

ingredients



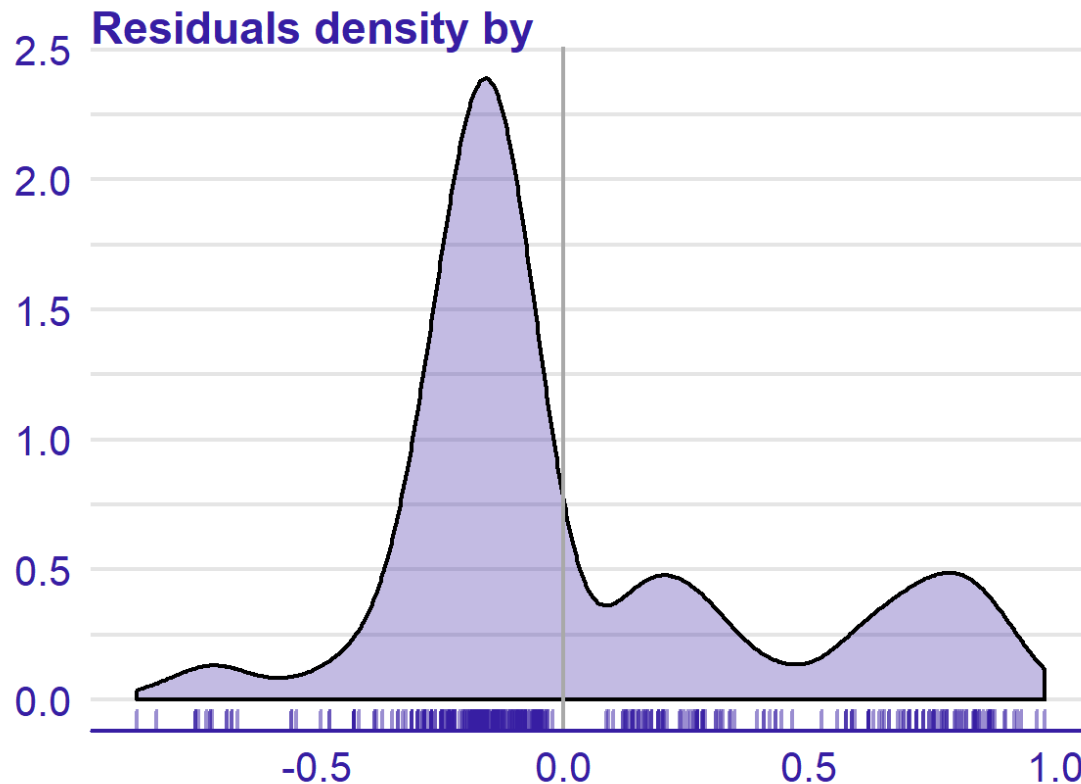
iBreakDown



explain_scikitlearn function

```
library(DALEXtra)
titanic_test <- read.csv(system.file("extdata", "titanic_test.csv", package = "DALEXtra"))
pk1_path <- system.file("extdata", "scikitlearn.pkl", package = "DALEXtra")
yaml_path <- system.file("extdata", "testing_environment.yaml", package = "DALEXtra")
explainer <- explain_scikitlearn(path = pk1_path,
                                yaml = yaml_path,
                                data = titanic_test[,-18],
                                y = titanic_test[,18]
                                )
```

auditor package



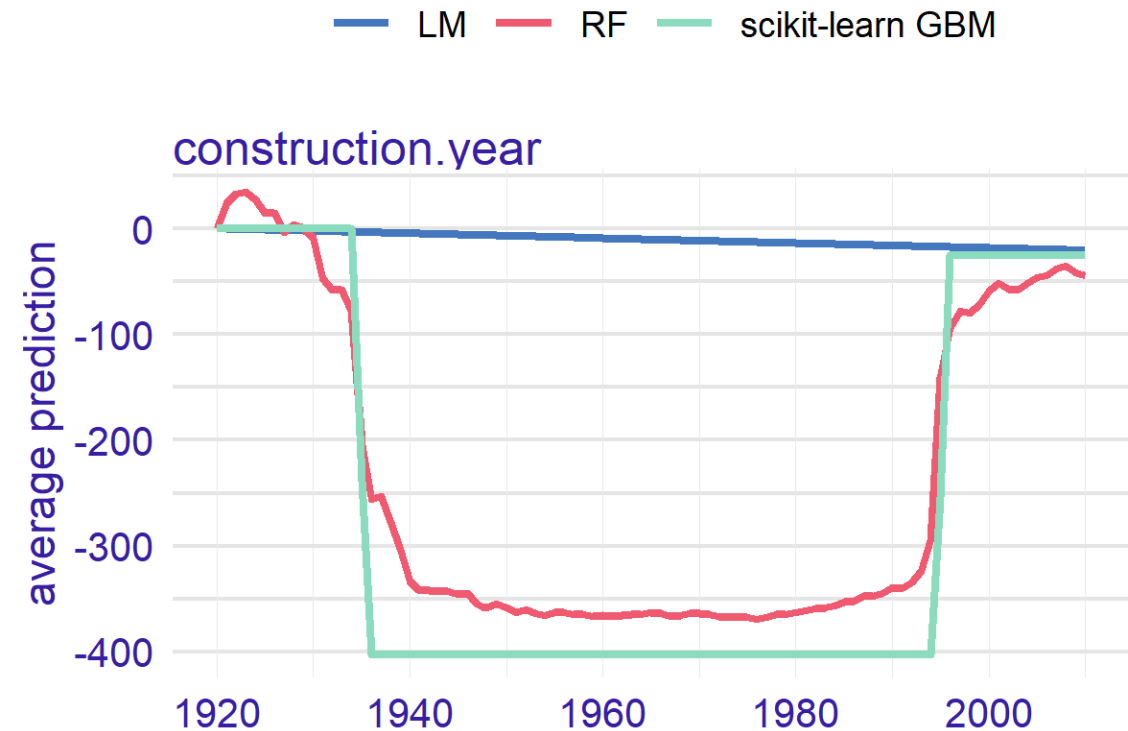
```
> explainer$param_set
criterion: friedman_mse
init: NULL
learning_rate: 0.1
loss: deviance
max_depth: 3
max_features: NULL
max_leaf_nodes: NULL
min_impurity_decrease: 0
min_impurity_split: NULL
min_samples_leaf: 1
min_samples_split: 2
min_weight_fraction_leaf: 0
n_estimators: 100
n_iter_no_change: NULL
presort: auto
random_state: NULL
subsample: 1
tol: 1e-04
validation_fraction: 0.1
verbose: 0
warm_start: FALSE
```

How can we use integration?

How can we compare
models?

Examples of methods for model comparison

- Residual audit
 - auditor package
- Explanation comparison
 - Variable importance, variable response
- Performance
 - Comparison of measures across whole test set or its subsets

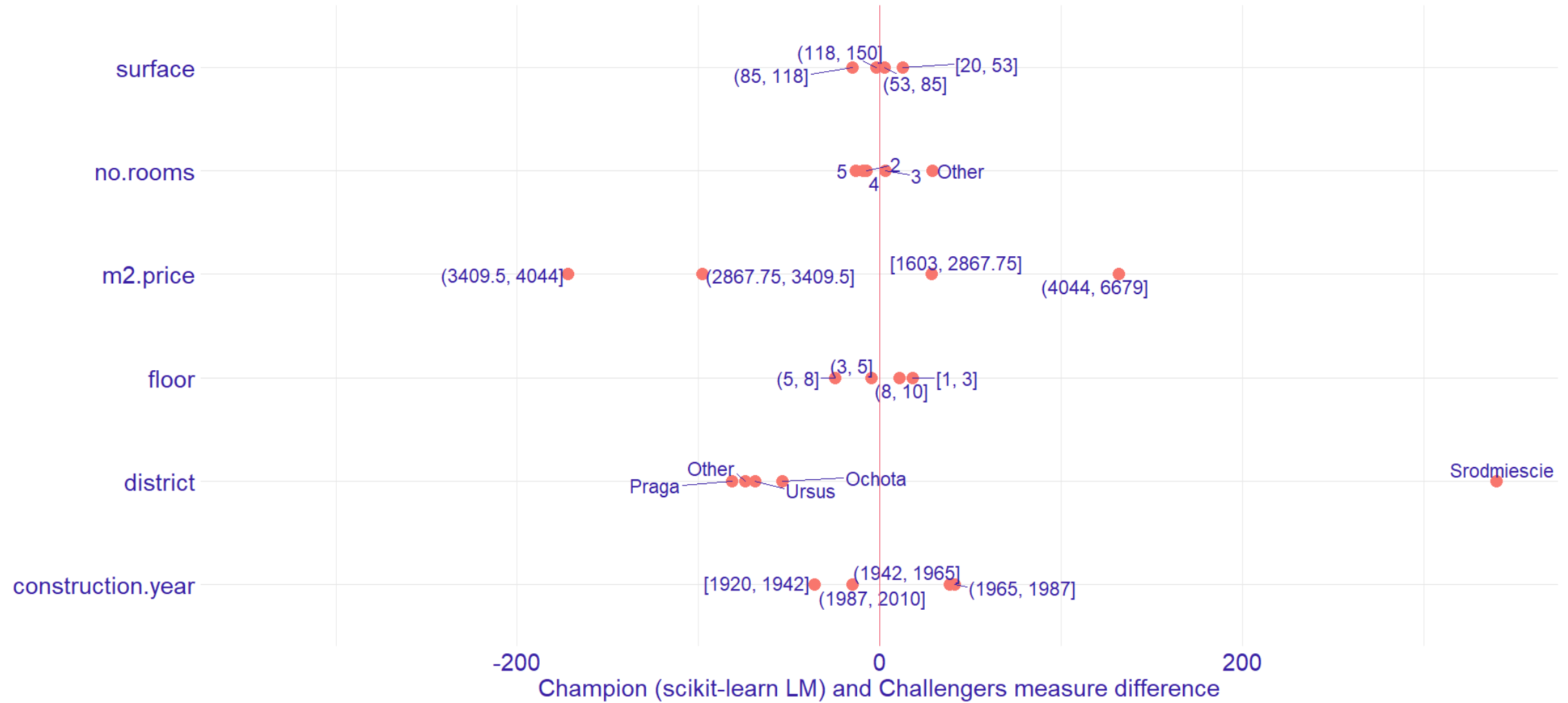


Funnel plot

Funnel Plot

For every colour, dot on the right side of red line means that Champion (scikit-learn LM) is better.
Dot on the left means that one of the Challengers is better than Champion (scikit-learn LM)

Challenger ● RF mlr



How to use it?

Most simple scenerio

```
plot_data <- funnel_measure(explainer_lm,  
                             explainer_rf)
```

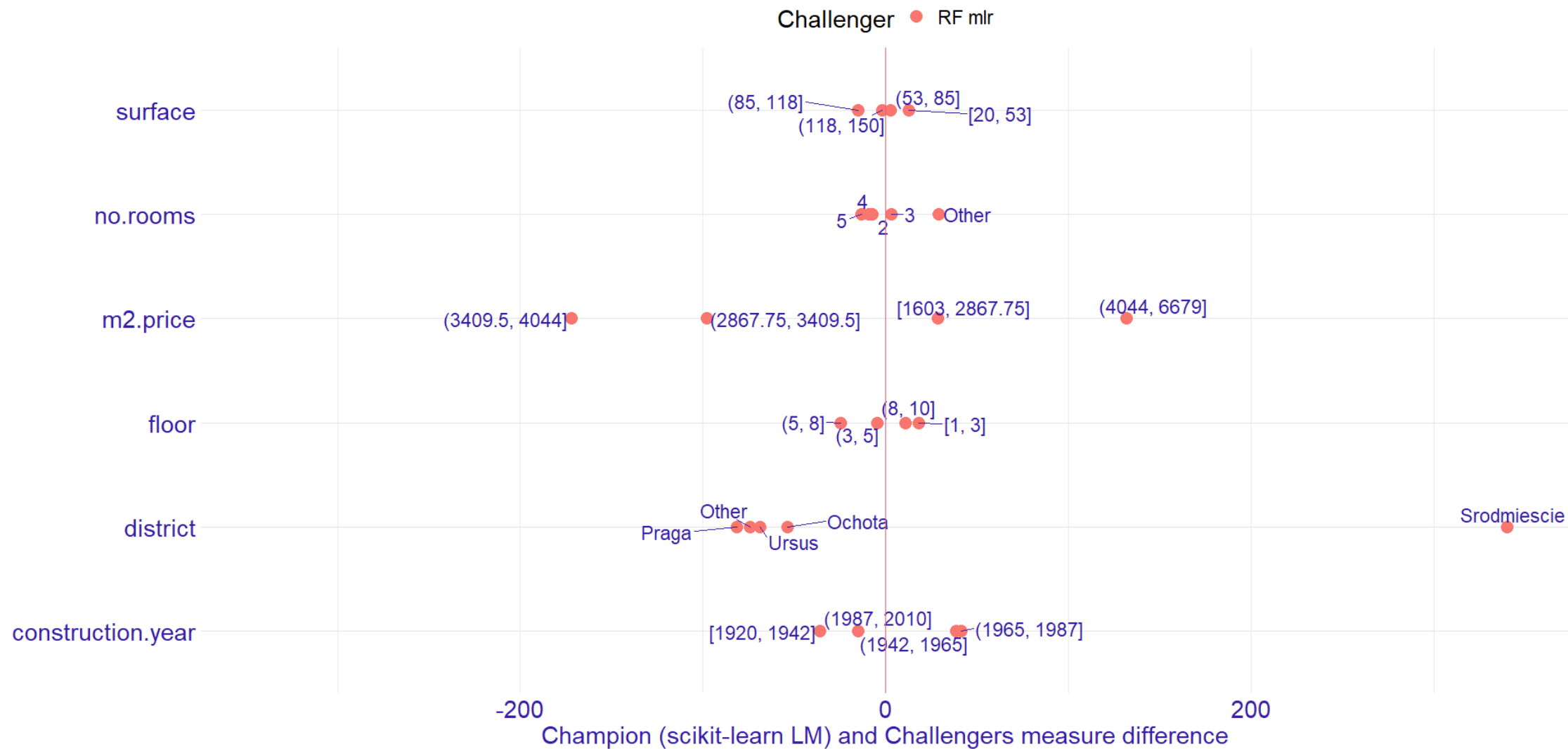
| | no.windows | developer.score | district |
|---|------------|-----------------|-------------|
| 1 | 2 | 0.8941622 | Srodmiescie |
| 2 | 10 | 0.2756634 | Bielany |
| 3 | 4 | 0.5523882 | Praga |
| 4 | 6 | 0.5332828 | Ochota |
| 5 | 10 | 0.4568613 | Mokotow |
| 6 | 4 | 0.8786960 | Srodmiescie |

Pro scenerio

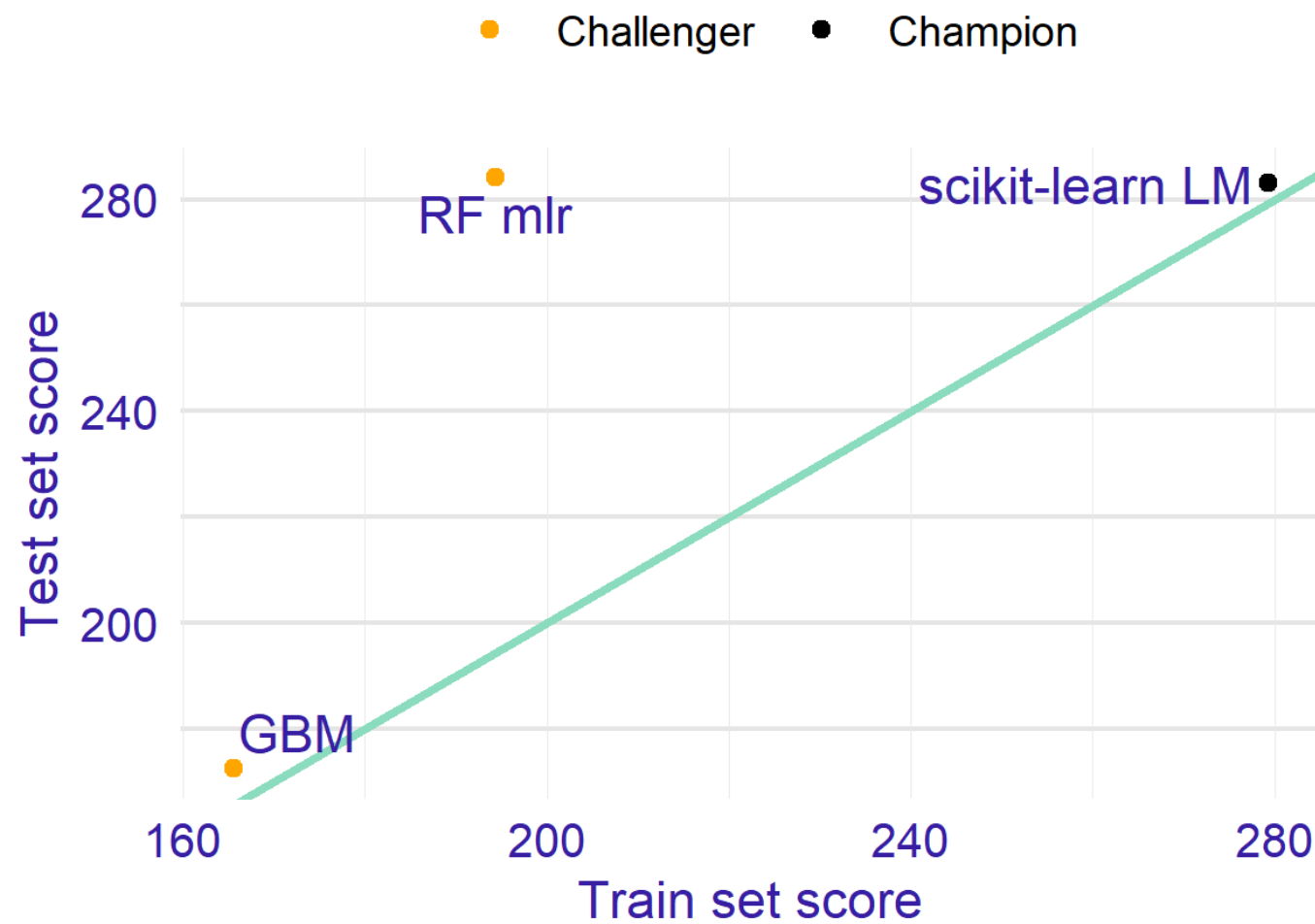
```
plot_data <- funnel_measure(champion = explainer_lm,  
                             challengers = list(explainer_rf, explainer_gbm),  
                             measure_function = DALEX::loss_root_mean_square,  
                             nbins = 6,  
                             partition_data = partition_data,  
                             cutoff = 0.1,  
                             cutoff_name = "other",  
                             factor_conversion_threshold = 7,  
                             show_info = TRUE  
                             )
```

Funnel Plot

For every colour, dot on the right side of red line means that Champion (scikit-learn LM) is better.
 Dot on the left means that one of the Challengers is better than Champion (scikit-learn LM)

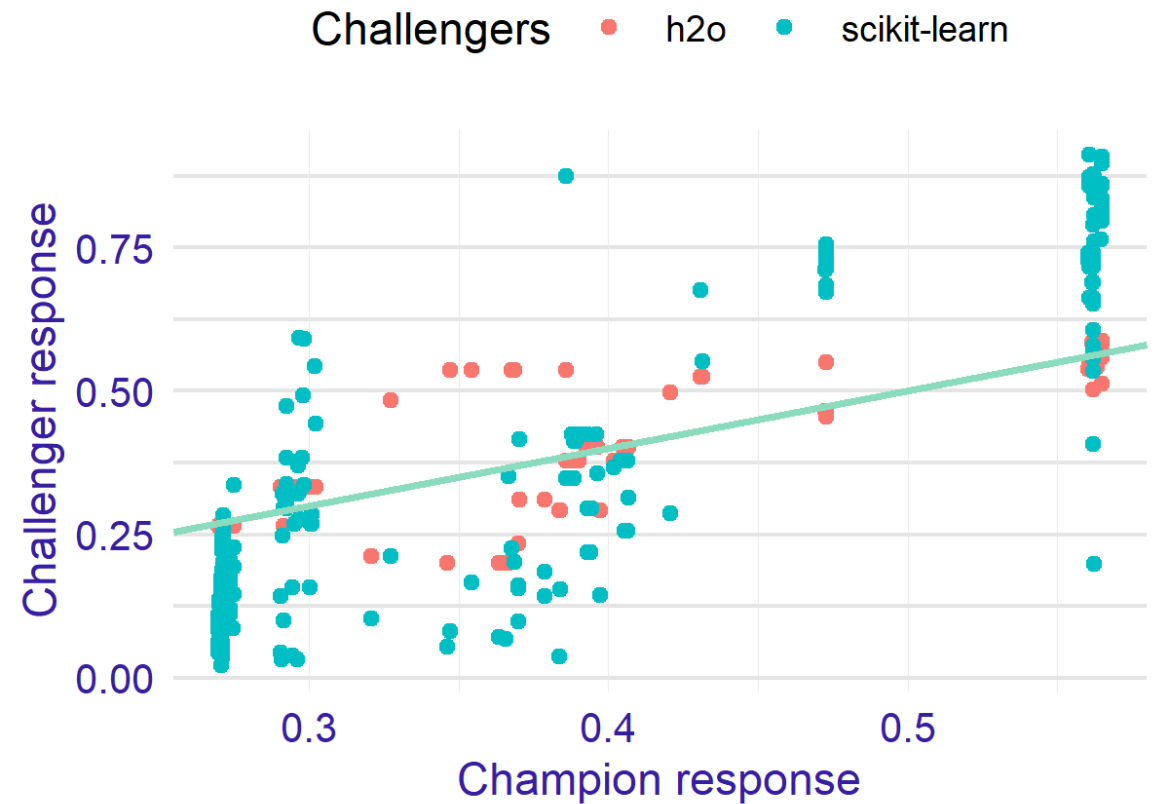
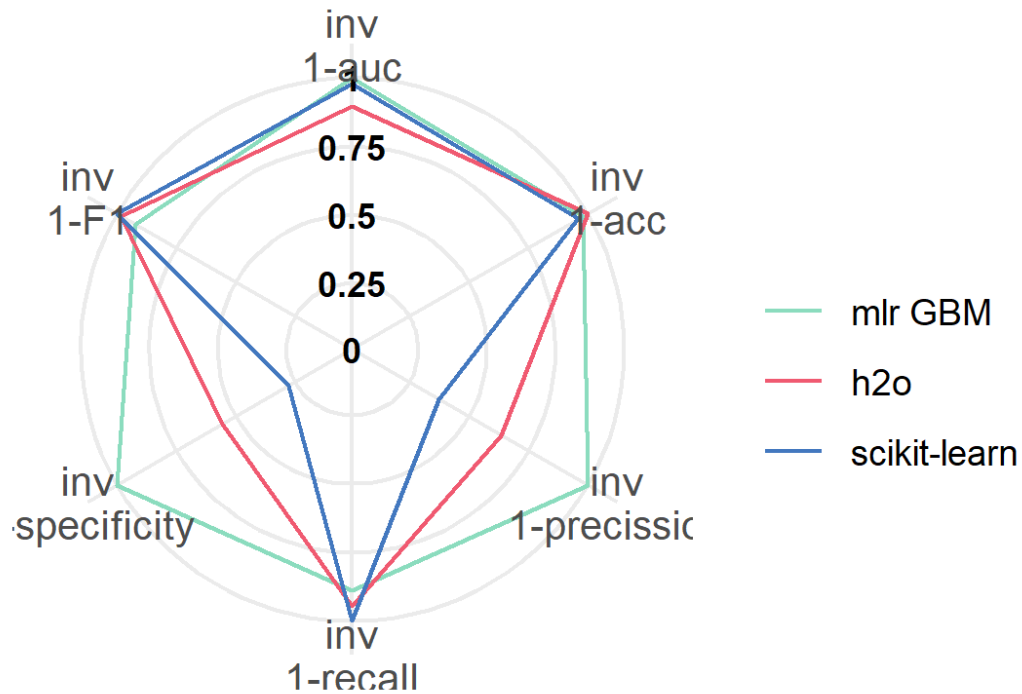


Performance audit



Overall comparison

Model ranking radar



Create report!

- Creates a report out of explanations.
- Every explanation with generic plot function can be included in the report as separate section
- Sections provided with DALEXtra have additional description in the output.

Here should be a screen of the report but I've decided to show whole instead! 😊



MI2DataLab research lab is looking for you!

Are you are intreseted in XAI, AutoML, AutoEDA other innovations in the next generation of ML?

Come to us
<http://bit.do/MI2isHiring>



Acknowledgments

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- dr Michał Burdukiewicz
- Alicja Gosiewska
- Mateusz Staniak
- Whole MI2DataLab team

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- <https://CRAN.R-project.org/package=auditor>
- <https://CRAN.R-project.org/package=DALEX>
- <https://CRAN.R-project.org/package=iBreakDown>
- <https://CRAN.R-project.org/package=ingredients>