



# Surpassing the R vs Python dogma

Dana Jomar, Clemens Zauchner

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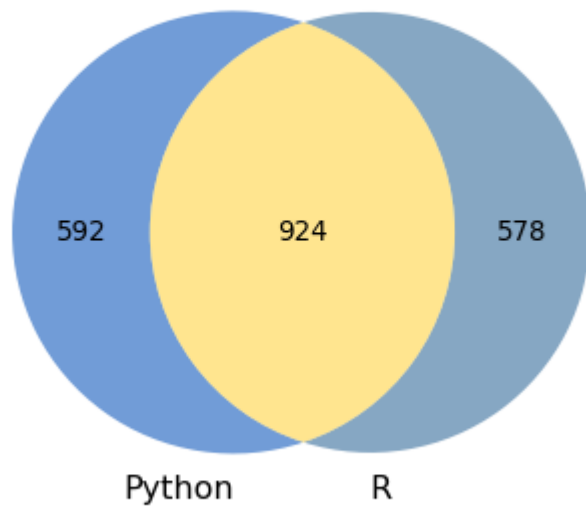
- \* Background - why we are talking about it
- \* Ways of closing the gap
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# Background

- \* There is an argument in the data science space
- \* Can be observed by countless articles / blog posts etc on R vs Python
- \* **BUT:** this argument is not very helpful and divisive
- \* Focus should be on the task at hand, not the tools
- \* you can drill a hole with a hammer, but it won't be elegant
- \* Both tools have strengths and weaknesses (not part of this talk)
- \* You are here to solve a problem, not to have a favourite algorithm or tool

# Reality check

KD Nuggets Poll 2018: most of the people who use Python or R use both



	Total	Percent
R or Python Users	2094	100 %
R and Python	924	44.13 %
R only	578	27.6 %
Python only	592	28.27%

# What Python and R have in common

- \* A lot of data science teams use both
- \* both languages have rich interfaces to C / C++
- \* most of under-the-hood coding is done in C / C++

**Would it not make sense to aim for interoperability?**

# Feather

- \* Python and R use data frames as a fundamental data structure
- \* Pandas data frame are based on the idea of R's data frames
- \* Implemented after the announcement of Apache Arrow
- \* Aim: share data between Python and R
- \* Use a binary file format for data frames
- \* bridge time until Apache Arrow is implemented
- \* Uses the Apache Arrow columnar specification to represent binary data **on disk** (zero-copy access)
- \* Fast, lightweight, and easy-to-use binary file format for storing data frames.
- \* High read and write performance.

# Limitations of Feather

- \* Quickly exchange data between Python and R code, however it's not designed for long-term data storage.
- \* Supports limited scalar value types, adequate only for representing typical data found in R and pandas
- \* Supports only a single batch of rows (no ability to append to existing files)
- \* Only non-nested data types and categorical (dictionary-encoded) types are supported

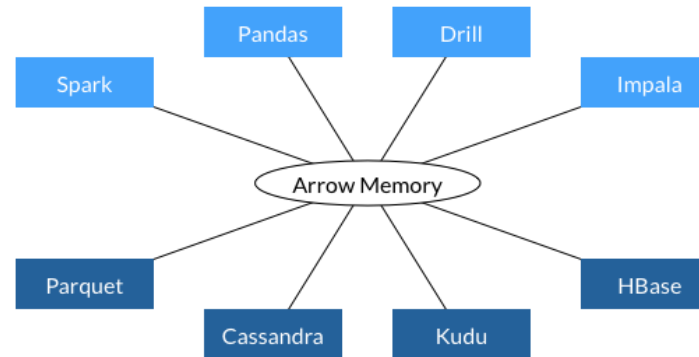
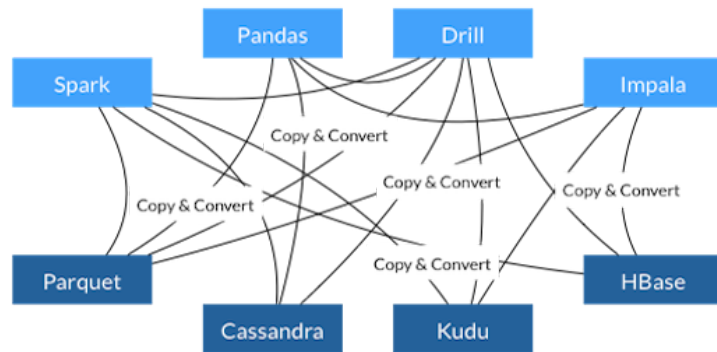
# Apache Arrow

A standardised, language-independent representation of in-memory columnar data

- \* Exchange data without conversion between the different languages including python and R (also C, C++, C#, Go, Java, JavaScript, MATLAB, Ruby, and Rust.)
- \* Zero-copy dataflow
- \* Optimised for analytic purposes
- \* Supports flat and nested format and conveniently many native data types
- \* Backed by key developers of 13 major open source projects (including Cassandra, Hadoop, HBase, Parquet, Spark, ... )



# Apache Arrow



- \* Each system has its own internal memory format
- \* 70-80% computation wasted on serialization and deserialization
- \* Similar functionality implemented in multiple projects
- \* All systems utilize the same memory format
- \* No overhead for cross-system communication
- \* Projects can share functionality

source: [arrow.apache.org](https://arrow.apache.org)

# Ursa Labs

When it comes to the most fundamental tasks (data access, data manipulation, data analysis, ..... ), data science tools are not optimised to make use of state-of-the-art hardware, as the efforts have been mainly focused on machine learning problems.

- \* Ursa Labs is an organisation founded
- \* by Wes McKinney (and Hadley Wickham as advisor for R)
- \* with the goal of advancing open source, cross-language software for data scientists
- \* Focuses on the data science tools of the Apache Arrow Project (Arrow has a broader application scope)
- \* May expand to create software artifacts focused more specifically on the data science domain

# Rstudio 1.2 / reticulated python

## The package: reticulate

- \* Reticulate is an R package that makes it possible to embed a Python session within an R process.
- \* Provides wrapper functions to use python modules and scripts
  - `import`, `python_source`, `repl_python`, `use_python`, `py_install`, .....
- \* Data conversion back and forth between the two languages happens through C++
- \* R and Python variables are accessible from both environments
  - The objects `py` and `r` provide this access

# Type conversion

R	Python	Examples
Single-element vector	Scalar	1, 1L, TRUE, "foo"
Multi-element vector	List	c(1.0, 2.0, 3.0), c(1L, 2L, 3L)
List of multiple types	Tuple	list(1L, TRUE, "foo")
Named list	Dict	list(a = 1L, b = 2.0), dict(x = x_data)
Matrix/Array	NumPy ndarray	matrix(c(1,2,3,4), nrow = 2, ncol = 2)
Data Frame	Pandas DataFrame	data.frame(x = c(1,2,3), y = c("a", "b", "c"))
Function	Python function	function(x) x + 1
NULL, TRUE, FALSE	None, True, False	NULL, TRUE, FALSE

source: <https://rstudio.github.io/reticulate/>

# Rstudio 1.2 / reticulated python

## The IDE: Rstudio 1.2

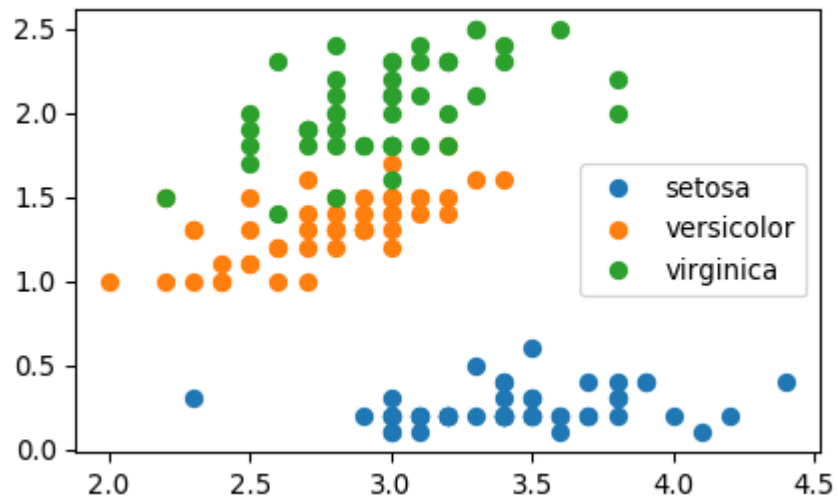
- \* Automatic access to a python REPL when stepping into a python script
- \* read-eval-print loop
- \* interactive language shell
- \* simple, interactive computer programming environment
- \* Line-by-line execution of Python code
- \* Support for Python syntax highlighting
- \* Autocompletion and Inline help for Python ..... HOOORAY!!!
- \* R notebooks with Python code chunks
- \* Automatic switch in the code history pane between Python and R
- \* Sourcing full Python scripts
- \* Display of matplotlib plots within the plots pane in RStudio and inline in the notebooks

# R Notebooks

```
222 ## Python Code
223 ```{python include=TRUE, echo=TRUE, fig.height = 3, fig.width = 5}
224 import matplotlib.pyplot as plt
225 import pandas as pd
226
227 # get data from R
228 iris_groups = r.iris.groupby('Species')
229 # and plot with python
230 fig, ax = plt.subplots()
231 for name, group in iris_groups:
232     ax.plot(group['Sepal.Width'], group['Petal.Width'], 'o', label=name)
233 ax.legend()
234 plt.show()
235 ```
236
237 ```{python}
238 diamonds = pd.read_csv('https://raw.githubusercontent.com/mwaskom/seaborn-data/master/diamonds.csv')
239 ```
240
241 ## R Code
242 ```{r include=TRUE, echo=TRUE, fig.height = 4, fig.width = 7}
243 library(reticulate)
244 library(ggplot2)
245 # get data from Python and plot with R
246 ggplot(py$diamonds, aes(cut, carat)) +
247   geom_boxplot(aes(color = cut), na.rm = TRUE, show.legend = FALSE)+
248   theme(axis.text.x = element_text(angle = 45, hjust = 1))
249
250 ```
251
```

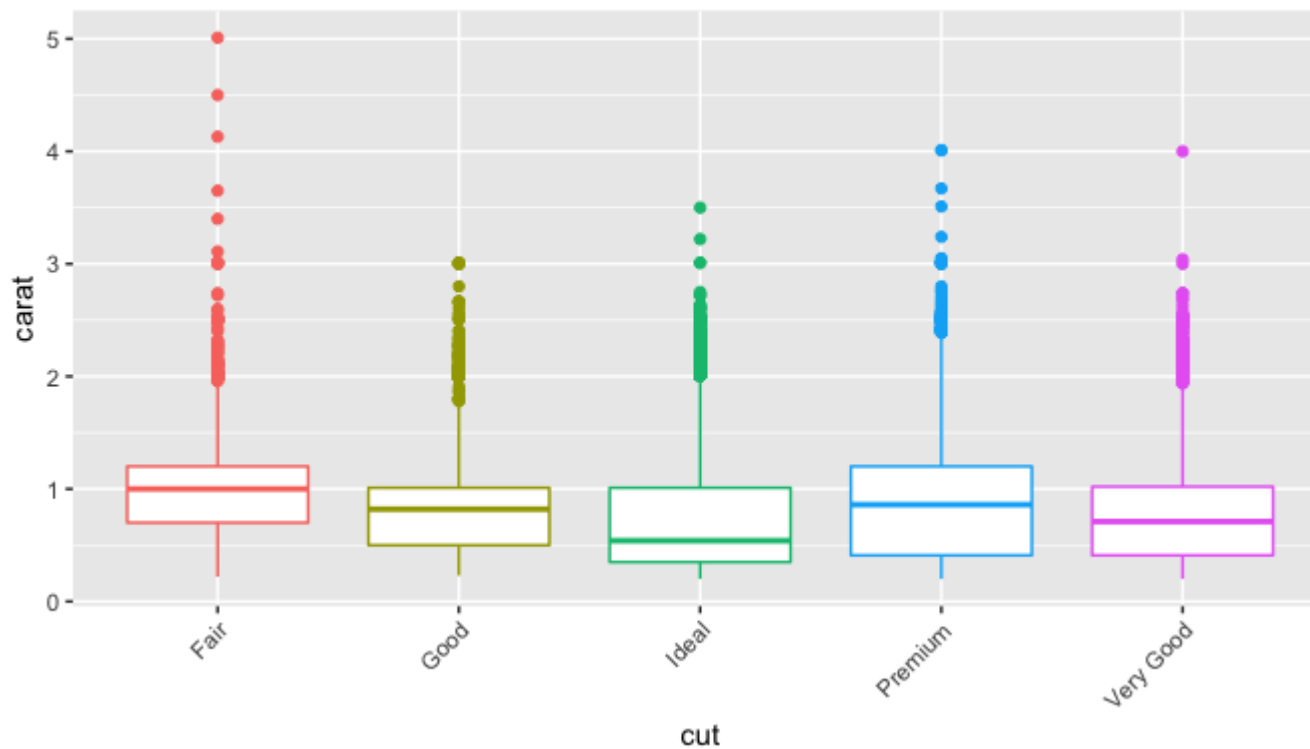
# Python Code

```
import matplotlib.pyplot as plt
import pandas as pd
# get data from R
iris_groups = r.iris.groupby('Species')
# and plot with python
fig, ax = plt.subplots()
for name, group in iris_groups:
    ax.plot(group['Sepal.Width'], group['Petal.Width'], 'o', label=name)
ax.legend()
plt.show()
```



# R Code

```
library(reticulate)
library(ggplot2)
# get data from Python and plot with R
ggplot(py$diamonds, aes(cut, carat)) +
  geom_boxplot(aes(color = cut), na.rm = TRUE, show.legend = FALSE)+
  theme(axis.text.x = element_text(angle = 45, hjust = 1))
```





# Is RStudio a good alternative as a Python IDE?

- \* It makes switching from R to Python certainly easier
- \* It supports syntax highlighting and autocomplete
- \* It is not intended as a Python IDE (yet?)
- \* Since it's slightly painful, it's probably a Python IDE for data science though ;)

# Conclusion

- \* R **vs** Python is now R **and** Python
  - It's not about the tool, it's about the task at hand
- \* There are many initiatives to bring the tools closer together
  - Ursa labs => Apache Arrow
  - RStudio => Python integration
- \* The dogmatic war was boring before it started
- \* This is the time to start to embrace the strengths of the tools and to collaborate

Questions?

# Sources

- \* <https://towardsdatascience.com/from-r-vs-python-to-r-and-python-aa25db33ce17>
- \* <https://www.kdnuggets.com/2017/06/ecosystem-data-science-machine-learning-software.html/2>
- \* <http://ursalabs.org/tech/>
- \* <http://wesmckinney.com/blog/feather-arrow-future/>
- \* <https://arrow.apache.org/>