Use Python with R with reticulate : : **CHEAT SHEET**

The **reticulate** package lets you use Python and R together seamlessly in R code, in R Markdown documents, and in the RStudio IDE.

Python in R Markdown

(Optional) Build Python env to use.

Add **knitr::knit_engines$set(python = reticulate::eng_python)** to the setup chunk to set up the reticulate Python engine (not required for knitr >= 1.18).

Suggest the Python environment to use, in your setup chunk.

Begin Python chunks with ` ```{python} `. Chunk options like **echo**, **include**, etc. all work as expected.

Use the **py** object to access objects created in Python chunks from R chunks.

Python chunks all execute within a **single** Python session so you have access to all objects created in previous chunks.

Use the **r** object to access objects created in R chunks from Python chunks.

Output displays below chunk, including matplotlib plots.

```
python.Rmd
1  ```{r setup, include = FALSE}
2  library(reticulate)
3  virtualenv_create("fmri-proj")
4  py_install("seaborn", envname = "fmri-proj")
5  use_virtualenv("fmri-proj")
6  ```
7
8  ```{python, echo = FALSE}
9  import seaborn as sns
10 fmri = sns.load_dataset("fmri")
11 ```
12
13 ```{r}
14 f1 <- subset(py$fmri, region == "parietal")
15
16
17 ```{python}
18 import matplotlib as mpl
19 sns.lmplot("timepoint","signal", data=r.f1)
20 mpl.pyplot.show()
21 ```
```
R Console   R Markdown

```
python.r
1  library(reticulate)
2  py_install("seaborn")
3  use_virtualenv("r-reticulate")
4
5  sns <- import("seaborn")
6
7  fmri <- sns$load_dataset("fmri")
8  dim(fmri)
9
10 # creates tips
11 source_python("python.py")
12 dim(tips)
13
14 # creates tips in main
15 py_run_file("python.py")
16 dim(py$tips)
17
18 py_run_string("print(tips.shape)")
19
```
R Script

Python in R

Call Python from R code in three ways:

IMPORT PYTHON MODULES

Use **import()** to import any Python module. Access the attributes of a module with **$**.

- **import(**module, as = NULL, convert = TRUE, delay_load = FALSE**)** Import a Python module. If convert = TRUE, Python objects are converted to their equivalent R types. Also **import_from_path()**. import("pandas")
- **import_main(**convert = TRUE**)** Import the main module, where Python executes code by default. import_main()
- **import_builtins(**convert = TRUE**)** Import Python's built-in functions. import_builtins()

SOURCE PYTHON FILES

Use **source_python()** to source a Python script and make the Python functions and objects it creates available in the calling R environment.

- **source_python(**file, envir = parent.frame(), convert = TRUE**)** Run a Python script, assigning objects to a specified R environment. source_python("file.py")

RUN PYTHON CODE

Execute Python code into the **main** Python module with **py_run_file()** or **py_run_string()**.

- **py_run_string(**code, local = FALSE, convert = TRUE**)** Run Python code (passed as a string) in the main module. py_run_string("x = 10"); py$x
- **py_run_file(**file, local = FALSE, convert = TRUE**)** Run Python file in the main module. py_run_file("script.py")
- **py_eval(**code, convert = TRUE**)** Run a Python expression, return the result. Also **py_call()**. py_eval("1 + 1")

Access the results, and anything else in Python's **main** module, with **py**.

- **py** An R object that contains the Python main module and the results stored there. py$x

Object Conversion

Tip: To index Python objects begin at 0, use integers, e.g. 0L

Reticulate provides **automatic** built-in conversion between Python and R for many Python types.

R	↔	Python
Single-element vector		Scalar
Multi-element vector		List
List of multiple types		Tuple
Named list		Dict
Matrix/Array		NumPy ndarray
Data Frame		Pandas DataFrame
Function		Python function
NULL, TRUE, FALSE		None, True, False

Or, if you like, you can convert manually with

py_to_r(x**)** Convert a Python object to an R object. Also **r_to_py()**. py_to_r(x)

tuple(...**,** convert = FALSE**)** Create a Python tuple. tuple("a", "b", "c")

dict(...**,** convert = FALSE**)** Create a Python dictionary object. Also **py_dict()** to make a dictionary that uses Python objects as keys. dict(foo = "bar", index = 42L)

np_array(data, dtype = NULL, order = "C"**)** Create NumPy arrays. np_array(c(1:8), dtype = "float16")

array_reshape(x, dim, order = c("C", "F")**)** Reshape a Python array. x <- 1:4; array_reshape(x, c(2, 2))

py_func(f**)** Wrap an R function in a Python function with the same signature. py_func(xor)

py_main_thread_func(f**)** Create a function that will always be called on the main thread.

iterate(it, f = base::identity, simplify = TRUE**)** Apply an R function to each value of a Python iterator or return the values as an R vector, draining the iterator as you go. Also **iter_next()** and **as_iterator()**. iterate(iter, print)

py_iterator(fn, completed = NULL**)** Create a Python iterator from an R function. seq_gen <- function(x){n <- x; function() {n <<- n + 1; n}}; py_iterator(seq_gen(9))

Helpers

py_capture_output(expr, type = c("stdout", "stderr")**)** Capture and return Python output. Also **py_suppress_warnings()**. py_capture_output("x")

py_get_attr(x, name, silent = FALSE**)** Get an attribute of a Python object. Also **py_set_attr()**, **py_has_attr()**, and **py_list_attributes()**. py_get_attr(x)

py_help(object**)** Open the documentation page for a Python object. py_help(sns)

py_last_error() Get the last Python error encountered. Also **py_clear_last_error()** to clear the last error. py_last_error()

py_save_object(object, filename, pickle = "pickle", ...**)** Save and load Python objects with pickle. Also **py_load_object()**. py_save_object(x, "x.pickle")

with(data, expr, as = NULL, ...**)** Evaluate an expression within a Python context manager. py <- import_builtins(); with(py$open("output.txt", "w") %as% file, { file$write("Hello, there!")})

RStudio

Python in the IDE

Requires reticulate plus RStudio v1.2+. Some features require v1.4+.

Syntax highlighting for Python scripts and chunks.

Tab completion for Python functions and objects (and Python modules imported in R scripts).

Source Python scripts.

Execute Python code line by line with **Cmd + Enter** (**Ctrl + Enter**).

View Python objects in the Environment Pane.

View Python objects in the Data Viewer.

A Python **REPL** opens in the console when you run Python code with a keyboard shortcut. Type **exit** to close.

matplotlib plots display in plots pane.

Press **F1** over a Python symbol to display the help topic for that symbol.

Python REPL

A REPL (Read, Eval, Print Loop) is a command line where you can run Python code and view the results.

1. Open in the console with **repl_python()**, or by running code in a Python script with **Cmd + Enter** (**Ctrl + Enter**).
   - **repl_python(**module = NULL, quiet = getOption("reticulate.repl.quiet", default = FALSE), input = NULL**)** Launch a Python REPL. Run **exit** to close. repl_python()
2. Type commands at **>>>** prompt.
3. Press **Enter** to run code.
4. Type **exit** to close and return to R console.

```
Console   Terminal   Jobs
R   R 4.1.0 · ~/Desktop/cheat_sheets/
> reticulate::repl_python()
Python 3.6.13 (/Users/rstudiointern/Library/
r-miniconda/envs/r-reticulate/bin/python)
Reticulate 1.20 REPL -- A Python interpreter
 in R.
>>> import seaborn as sns
>>> tips = sns.load_dataset("tips")
>>> tips.shape
(244, 7)
>>> exit
>
```

Configure Python

Reticulate binds to a local instance of Python when you first call **import()** directly or implicitly from an R session. To control the process, find or build your desired Python instance. Then suggest your instance to reticulate. **Restart R to unbind.**

Find Python

- **install_python(**version, list = FALSE, force = FALSE**)** Download and install Python. install_python("3.6.13")

- **py_available(**initialize = FALSE**)** Check if Python is available on your system. Also **py_module_available()** and **py_numpy_module().** py_available()

- **py_discover_config()** Return all detected versions of Python. Use **py_config()** to check which version has been loaded. py_config()

- **virtualenv_list()** List all available virtualenvs. Also **virtualenv_root()**. virtualenv_list()

- **conda_list(**conda = "auto"**)** List all available conda envs. Also **conda_binary()** and **conda_version().** conda_list()

Create a Python env

- **virtualenv_create(**envname = NULL, ...**)** Create a new virtual environment. virtualenv_create("r-pandas")

- **conda_create(**envname = NULL, ...**)** Create a new conda environment. conda_create("r-pandas", packages = "pandas")

Install Packages

Install Python packages with R (below) or the shell:

pip install SciPy
conda install SciPy

- **py_install(**packages, envname, ...**)** Installs Python packages into a Python env. py_install("pandas")

- **virtualenv_install(**envname, packages, ...**)** Install a package within a virtualenv. Also **virtualenv_remove()**. virtualenv_install("r-pandas", packages = "pandas")

- **conda_install(**envname, packages, ...**)** Install a package within a conda env. Also **conda_remove()**. conda_install("r-pandas", packages = "plotly")

Suggest an env to use

Set a default Python interpreter in the RStudio IDE Global or Project Options.

Go to **Tools > Global Options... > Python** for Global Options.

Within a project, go to **Tools > Project Options... >Python**.
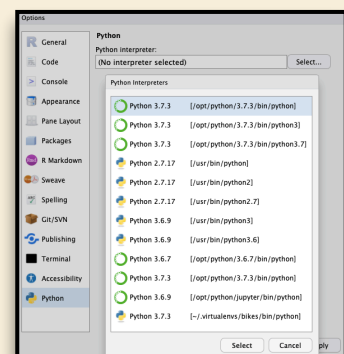
Otherwise, to choose an instance of Python to bind to, reticulate scans the instances on your computer in the following order, **stopping at the first instance that contains the module called by import()**.

1. The instance referenced by the environment variable **RETICULATE_PYTHON** (if specified). **Tip: set in .Renviron file.**

   - **Sys.setenv(**RETICULATE_PYTHON = PATH**)** Set default Python binary. Persists across sessions! Undo with **Sys.unsetenv()**. Sys.setenv(RETICULATE_PYTHON = "/usr/local/bin/python")

2. The instances referenced by **use_** functions if called before import(). Will fail silently if called after import unless **required = TRUE**.

   - **use_python(**python, required = FALSE**)** Suggest a Python binary to use by path. use_python("/usr/local/bin/python")

   - **use_virtualenv(**virtualenv = NULL, required = FALSE**)** Suggest a Python virtualenv. use_virtualenv("~/myenv")

   - **use_condaenv(**condaenv = NULL, conda = "auto", required = FALSE**)** Suggest a conda env to use. use_condaenv(condaenv = "r-nlp", conda = "/opt/anaconda3/bin/conda")

3. Within virtualenvs and conda envs that carry the same name as the imported module. e.g. ~/anaconda/envs/nltk for import("nltk")

4. At the location of the Python binary discovered on the system PATH (i.e. Sys.which("python"))

5. At customary locations for Python, e.g. /usr/local/bin/python, /opt/local/bin/python...