Statistics 360: Advanced R for Data Science

Lecture 11

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R and Python: References

- The reticulate website: https://rstudio.github.io/reticulate/
- Python setup: https://docs.python.org/3/using/index.html
- Python tutorial: https://docs.python.org/3/tutorial/
- TensorFlow website: https://www.tensorflow.org/overview

Calling Python from R

- Use cases:
  - Tap into a growing set of tools for data science, such as scikit-learn https://scikit-learn.org/stable/ , keras https://keras.io/ , ...
  - Workflow requires substantial computations in **both** languages; e.g., fit a neural network in Python, plot results using ggplot2
- Not recommended:
  - Using R/RStudio as a development environment for Python.
  - Better to go all-in with Python and use Jupyter Notebook as your IDE.

Prerequisites

- Install and load the reticulate package

```
library(reticulate)
```

- Install Python
  - See the Python setup link on the references slide
- Optional: Install the conda package manager https://conda.io/projects/conda/en/latest/user-guide/install/index.html
  - I'll use conda for creating environments and installing packages.
  - Users more familiar with virtual environments may prefer `venv` and `pip`.

Python packages and environments

- Python packages are like R packages.
  - Can be installed from the command line with `conda install <package>`.
- Python environments, like RStudio projects, are used to compartmentalize your work with Python.
  - A complete Python installation, including its own Python executable and packages.
  - Create from the command line with `conda create <env_name>`
  - Then "activate" with `conda activate <env_name>` and "de-activate" with `conda deactivate`.

Installing packages with reticulate

- See https://rstudio.github.io/reticulate/articles/python_packages.html

```
library(reticulate)
use_python("/home/mcneney/miniconda3/bin/python") # required on
#conda_create("r-reticulate") # commented out to avoid re-doing
# install packages into this environment
#conda_install("r-reticulate", "pandas") # commented out to avoi
```

Using a conda environment

- For each R session in which you want to use your conda environment:

```
use_condaenv("r-reticulate")
```

Python embedded in RMarkdown

- Example from https://pandas.pydata.org/pandas-docs/stable/user_guide/10min.html

````
# code chunk header is ```{python} rather than ```{r}
import numpy as np
import pandas as pd
df = pd.DataFrame(np.random.randn(3,4),columns=['A','B','C','D'])
df
````

```
##           A         B         C         D
## 0 -0.299609 -1.613999 -0.702521  0.537523
## 1 -0.962528 -1.672067 -0.240039  0.343303
## 2  1.109339  0.108826 -0.473801 -1.281742
```

Importing Python packages (modules)

- You can also import Python packages into R and call their functions directly.

```
npr <- import("numpy.random")
pd <- import("pandas") # import is from reticulate
df <- pd$DataFrame(npr$randn(3L,4L),columns=c('A','B','C','D'))
df
```

```
##           A           B         C           D
## 1 0.2652059 -0.10222907 1.1671894 -0.01848886
## 2 -0.3082251 -0.07525946 0.7973756 -0.28308337
## 3 -0.7318736 -1.06677428 1.2091364  0.31403976
```

Notes

- Access Python functions from an imported package with `$`.
- The `randn()` function requires integer arguments – have to use `3L` and `4L` to pass integers.
  - reticulate converts R vectors of length 1 to Python scalars.
  - In general reticulate will try to convert to/from appropriate data types. See the list at https://rstudio.github.io/reticulate/index.html#type-conversions
- I used the numpy random number generator, but passed column names as an R character vector.
  - reticulate converts this to a python list.

Sourcing Python scripts

- Source with `source_python()` and retrieve objects from an object named `py`.
  - `py` appears to be implemented as an environment, but behaves more like a list.

```
source_python("lec11_1.py")
ls(py) # is.environment(py)
```

```
## [1] "convert" "pyobj"
```

```
names(py)
```

```
## [1] "df"  "np"  "pd"  "r"   "R"   "sys"
```

```
py$df
```

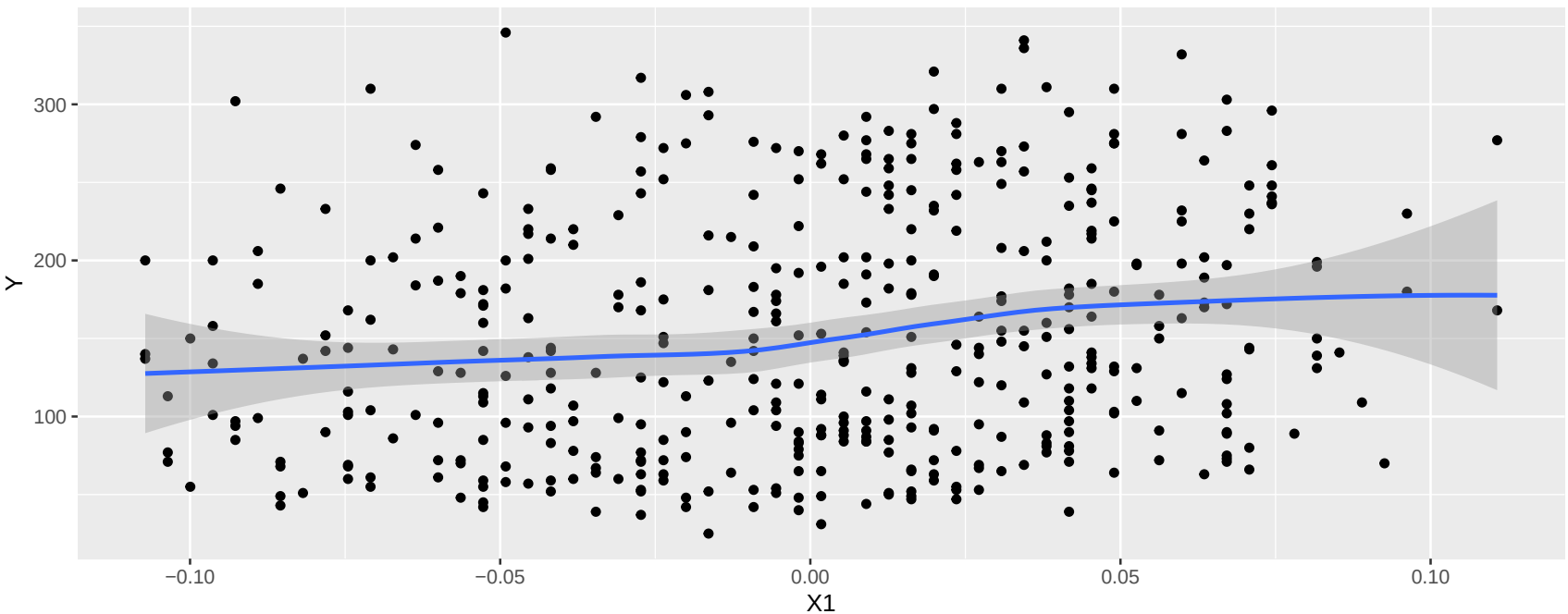
```
##             A          B          C           D
## 1  2.5879784 -0.5671912 -2.0823857 -1.08811464
## 2 -0.9801408  1.1703894  0.4922127  0.82152455
## 3  0.1064428  0.8422784 -0.6312484 -0.05571099
```

Another example

```
source_python("lec11_2.py")
py$MSE
```

```
## [1] 2859.69
```

```
ddat <- data.frame(Y=py$diabetes_y,py$diabetes_X)
library(ggplot2)
ggplot(ddat,aes(x=X1,y=Y)) + geom_point() + geom_smooth()
```



Python REPL

- You can also start the Python interpreter and compute interactively.
  - Useful for debugging your Python scripts

```
# repl_python()
# type your Python commands
# objects will be available in R through py object
# exit() to quit
```