

# Using reticulate to read and write NumPy files

Dirk Eddebuetel<sup>1</sup>

<sup>1</sup><http://dirk.eddebuetel.com>

This version was compiled on April 5, 2019

This vignette shows how to use the reticulate package to directly access the NumPy module for Python.

## Motivation

The **RcppCNPy** package by Eddebuetel and Wu (2016) provides a simple and reliable access to **NumPy** files. It does not require Python as it relies on the **cnpy** library which is connected to R with the help of **Rcpp Rcpp** (Eddebuetel and François, 2011; Eddebuetel, 2013; Eddebuetel *et al.*, 2018).

Now, thanks to the **reticulate** package by Allaire *et al.* (2018), we can consider an alternative which does not require **cnpy**—but which requires Python. We can (on a correctly set up machine, how to do that is beyond the scope of this note but described in the reticulate documentation) use Python to read **NumPy** data via **reticulate**.

This short note reproduces all the examples in the primary **RcppCNPy** vignette, but using **reticulate** instead of **cnpy**.

## Simple Examples

```
# load reticulate and use it to load numpy
library(reticulate)
np <- import("numpy")

# data reading
mat <- np$load("fmat.npy")
mat
#      [,1] [,2] [,3] [,4]
# [1,] 0.0  1.1  2.2  3.3
# [2,] 4.4  5.5  6.6  7.7
# [3,] 8.8  9.9 11.0 12.1

vec <- np$load("fvec.npy")
vec
# [1] 0.0 1.1 2.2 3.3 4.4
```

Integer data can be read the same way:

```
imat <- np$load("imat.npy")
imat
#      [,1] [,2] [,3] [,4]
# [1,]  0   1   2   3
# [2,]  4   5   6   7
# [3,]  8   9  10  11
```

## Compressed Files

The gzip Python module allows us to access compressed files.

```
# use the gzip modules for compressed data
gz <- import("gzip")
# use it to create handle to uncompressed file
```

```
mat2 <- np$load(gz$GzipFile("fmat.npy.gz", "r"))
mat2
#      [,1] [,2] [,3] [,4]
# [1,] 0.0  1.1  2.2  3.3
# [2,] 4.4  5.5  6.6  7.7
# [3,] 8.8  9.9 11.0 12.1
```

## Saving Files

Similarly, files can be saved via reticulate access to **NumPy**.

```
tfile <- tempfile(fileext=".npy")
set.seed(42)
m <- matrix(sort(rnorm(6)), 3, 2)
m
#      [,1] [,2]
# [1,] -0.564698 0.404268
# [2,] -0.106125 0.632863
# [3,] 0.363128 1.370958
np$save(tfile, m)

m2 <- np$load(tfile)
m2
#      [,1] [,2]
# [1,] -0.564698 0.404268
# [2,] -0.106125 0.632863
# [3,] 0.363128 1.370958

all.equal(m, m2)
# [1] TRUE
```

## Savez Array Files

We can also access savez files.

First we save two vectors two different ways:

```
x <- seq(1, 10)
y <- sin(x)
np$savez("file1.npz", x, y)
np$savez("file2.npz", x=x, y=y)
```

We can access these files with and without names:

```
npz1 <- np$load("file1.npz")
npz1$files
# [1] "arr_1" "arr_0"
npz1$f[["arr_0"]]
# [1] 1 2 3 4 5 6 7 8 9 10
npz1$f[["arr_1"]]
# [1] 0.841471 0.909297 0.141120 -0.756802
# [5] -0.958924 -0.279415 0.656987 0.989358
# [9] 0.412118 -0.544021
```

Ditto for the second file:

```
npz2 <- np$load("file2.npz")
npz2$files
# [1] "y" "x"
npz2$f[["x"]]
# [1] 1 2 3 4 5 6 7 8 9 10
npz2$f[["y"]]
# [1] 0.841471 0.909297 0.141120 -0.756802
# [5] -0.958924 -0.279415 0.656987 0.989358
# [9] 0.412118 -0.544021
```

### Three-dimensional Arrays

We can also import three-dimensional array from **NumPy** as the next example shows.

```
arr <- np$load("arr.npy")
arr
# , , 1
#
#      [,1] [,2] [,3]
# [1,]  0    2    4
# [2,]  6    8   10
# [3,] 12   14   16
# [4,] 18   20   22
#
# , , 2
#
#      [,1] [,2] [,3]
# [1,]  1    3    5
# [2,]  7    9   11
# [3,] 13   15   17
# [4,] 19   21   23
```

### Summary

While the **RcppCNPY** package provides functions for the simple reading and writing of **NumPy** files, we can also use the **reticulate** package to access the **NumPy** functionality directly from R.

**RcppCNPY** remains an attractive option for simple, direct and lighter-weight file imports whereas **reticulate** by by [Allaire et al. \(2018\)](#) shines a more full-featured access to many more aspects of Python.

### References

- Allaire J, Ushey K, Tang Y (2018). *reticulate: Interface to 'Python'*. R package version 1.9, URL <https://CRAN.R-project.org/package=reticulate>.
- Eddelbuettel D (2013). *Seamless R and C++ Integration with Rcpp*. Use R! Springer, New York. ISBN 978-1-4614-6867-7.
- Eddelbuettel D, François R (2011). "Rcpp: Seamless R and C++ Integration." *Journal of Statistical Software*, **40**(8), 1–18. URL <http://www.jstatsoft.org/v40/i08/>.
- Eddelbuettel D, François R, Allaire J, Ushey K, Kou Q, Russel N, Chambers J, Bates D (2018). *Rcpp: Seamless R and C++ Integration*. R package version 0.12.17, URL [package=Rcpp](https://CRAN.R-project.org/package=Rcpp).
- Eddelbuettel D, Wu W (2016). "RcppCNPY: Read-Write Support for NumPy Files in R." *Journal of Open Source Software*, **1**. URL <http://dx.doi.org/10.21105/joss.00055>.