Tracking machine learning models in R with MLflow

In this story I have briefly described what ***MLflow*** is and how it works. *MLflow* currently provides APIs in Python language that users can invoke in their machine learning source codes to log parameters, metrics, and artifacts to be tracked by the *MLflow* tracking server.

Users familiar with R and perform machine learning operations in R may like to track their models and every runs with *MLflow*. There are several approaches users can take.

- Waiting for *Mlflow* to release the APIs in R, or
- Wrapping *MLflow* RESTful APIs and logging through `curl` commands, or
- Calling existing Python APIs with some R packages that can invoke Python interpreter

The last approach is simple and easy enough while allows users to interact with *MLflow* without waiting for R APIs to be available. I will illustrate how to achieve this with R package ***reticulate***.

reticulate is an open source R package that allows to call Python from R by embedding a Python session within the R session. It provides seamless and high-performance interoperability between R and Python. The package is available in CRAN repository.

Before beginning, you should have Python installed on the environment where R is running. I prefer installing miniconda.

Once the Python is installed, you can create a virtualenv for *MLflow* and install mlflow package as follow (with `conda`):

```
conda create -q -n mlflow python=3.6
source activate mlflow
pip install -U pip
pip install mlflow
```

Next install reticulate package through R.

```
install.packages("reticulate")
```

`reticulate` allows R to call Python functions seamlessly. The Python package is loaded by the `import` statement. Calling to a function is through `$` operator.

```
> library(reticulate)
> path <- import("os.path")
> path$isdir("/tmp")
[1] TRUE
```

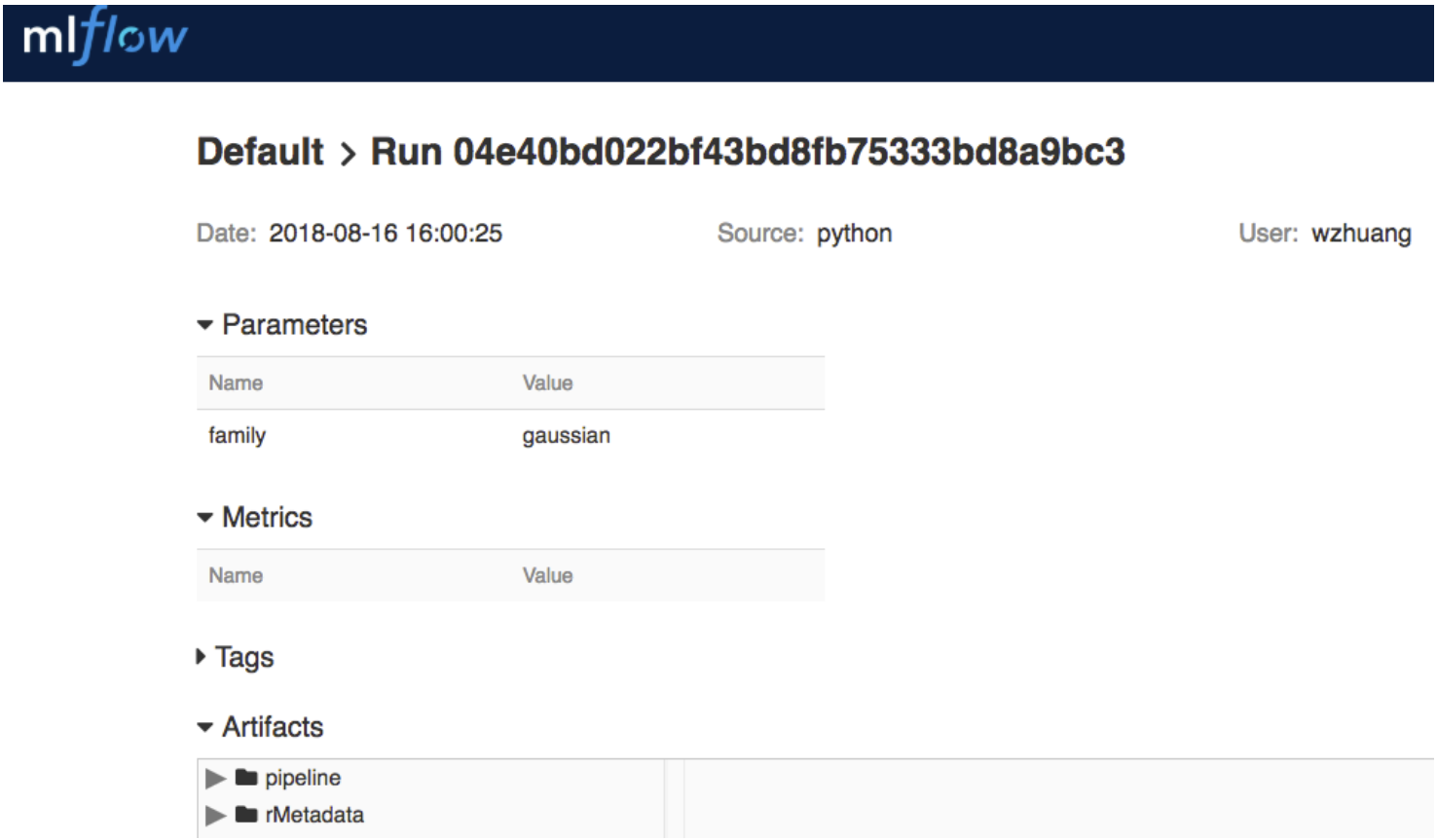
As you can see above, it is very simple to call Python functions in `os.path` module from R with this package. So you can do the same thing with `mlflow` package by importing it and then call `mlflow$log_param` and `mlflow$log_metric` to log parameters and metrics for the R script.

Following R script builds a linear regression model with SparkR. You need `SparkR` package installed for this example.

```
# load the reticulate package and import mlflow Python module
library(reticulate)
mlflow <- import("mlflow")

# load SparkR package and start spark session
library(SparkR, lib.loc = c(file.path(Sys.getenv("SPARK_HOME"), "R", "lib")))
sparkR.session(master="local[*]")

# convert iris data.frame to SparkDataFrame
df <- as.DataFrame(iris)

# parameter for GLM
family <- c("gaussian")

# log the parameter
mlflow$log_param("family", family)

# fit the GLM model
model <- spark.glm(df, Species ~ ., family = family)

# exam the model
summary(model)

# path to save the model
model_path <- "/tmp/mlflow-GLM"

# save the model
write.ml(model, model_path)

# log the artifact
mlflow$log_artifacts(model_path)

# stop spark session
sparkR.session.stop()
```

You can either copy the script to `R` or Rstudio and run interactively, or save it to a file and run with `Rscript` command. Make sure that the `PATH` environment variable includes the path to the *mlflow* Python virtualenv.

Once the script finishes, go to *MLflow* UI, the run is now showing and so it can be tracked. Here is a snapshot.



In conclusion, this approach lets R users take benefit of *MLflow* `Tracking` component and track their R models in a quick way. I will show how R users can use the other two components (`Projects` and `Models`) of *MLflow* in future stories.