Tableau for Data Scientists

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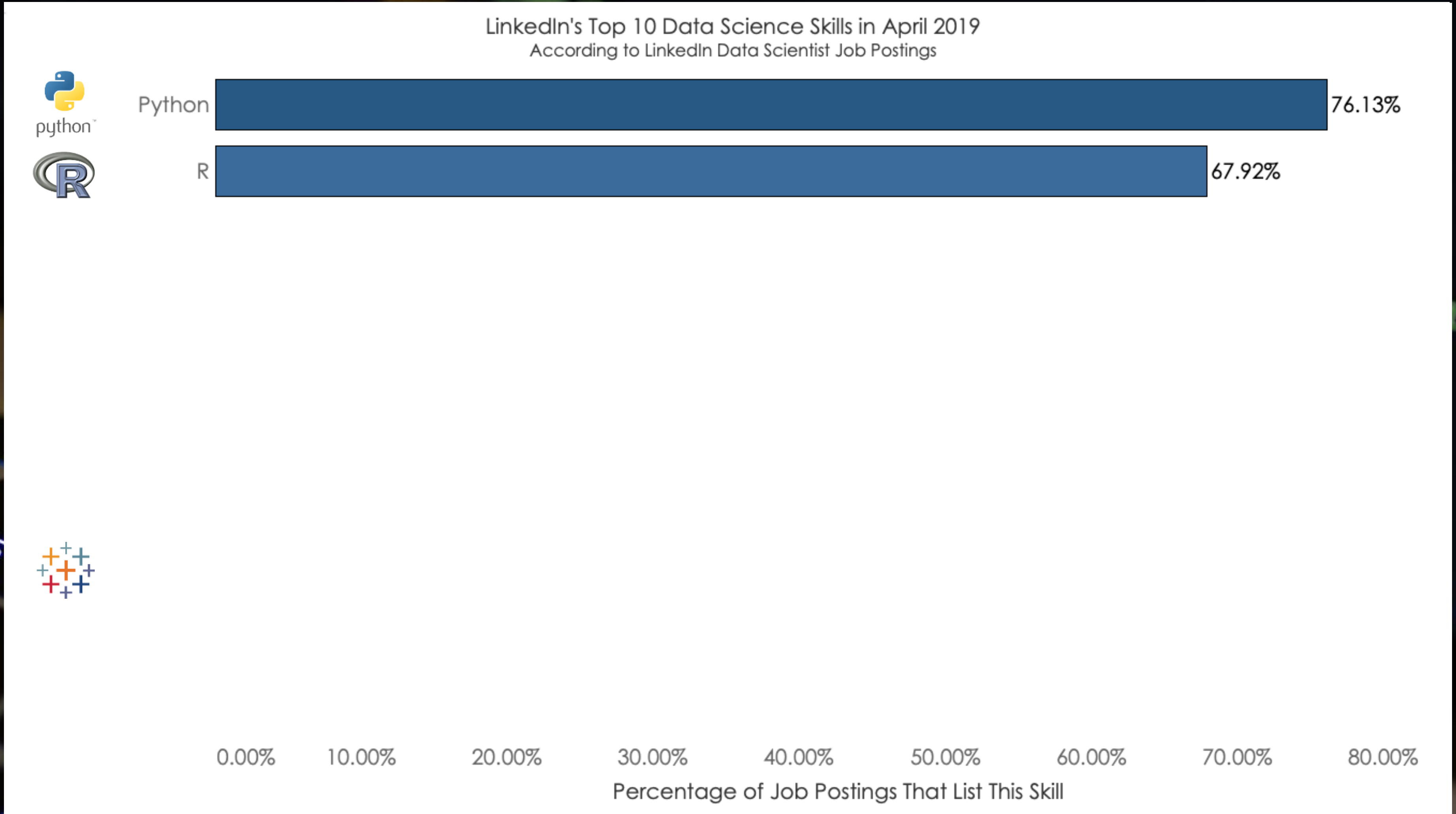
Customer Consultant

Tableau

Understanding the Why

Why Python? Why R? Why Tableau?



"Visualization of data (static or interactive).

Storytelling with data. This is a critical skill.

In essence, can someone with no background in whatever area your project is in look at your project and gain some new understandings from it?"

https://www.forbes.com/sites/louiscolumbus/2019/04/14/how-to-get-your-data-scientist-career-started/#3eeb52a47e5c

tableau

Sales Performance vs Target
Furniture
Office Supplies
Technology
Above Target - Corporate Office Supplies
August 2015

We help people see and understand their data.

Telling your story.

Advanced Analytical Languages

- Peer-reviewed mathematical and statistics packages built by domain experts
- Enrich data with machine learning and natural language processing libraries
- Perform heavy statistical testing
- Create and iterate on regression model

+

Visual Analytics in Tableau

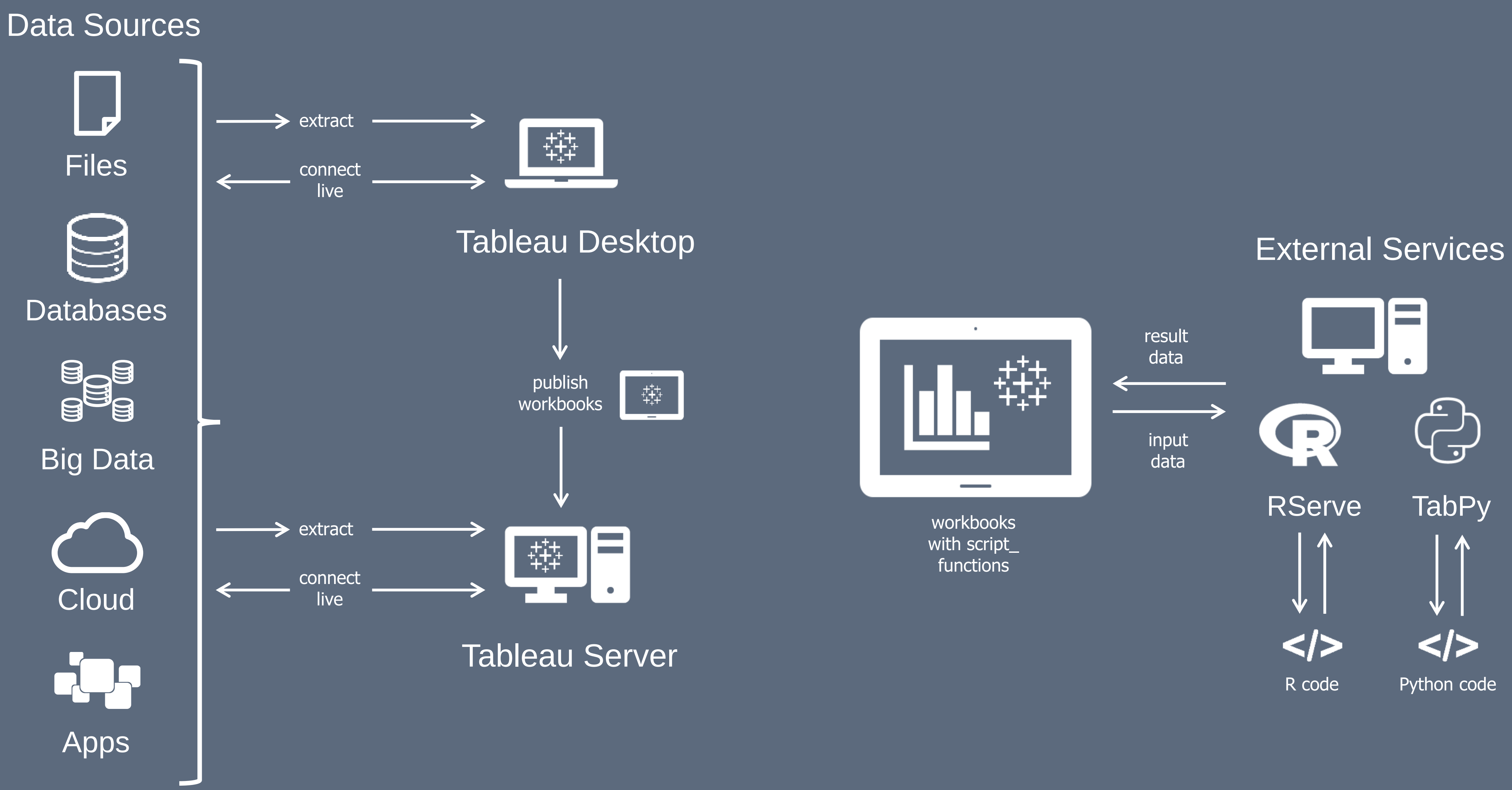
- Tableau's visual analytics makes it faster and easier to identify patterns, trends and relationships
- Tableau allows users to easily share and communicate insights
- Tableau enables users to ask and answer their own questions

Combined Benefits

- Enable broader audiences to use sophisticated models and statistics in decision-making
- Empower analytical package power-users to uncover more through fluid data exploration
- Enhance the OOTB function-library with available statistical libraries and centralized algorithms
- Easily tell your data story!

Understanding the How

How does it work?



Data Sources

Files

Databases

Big Data

Cloud

Apps

extract

connect live

Tableau Desktop

publish workbooks

extract

connect live

Tableau Server

workbooks with script_ functions

result data

input data

External Services

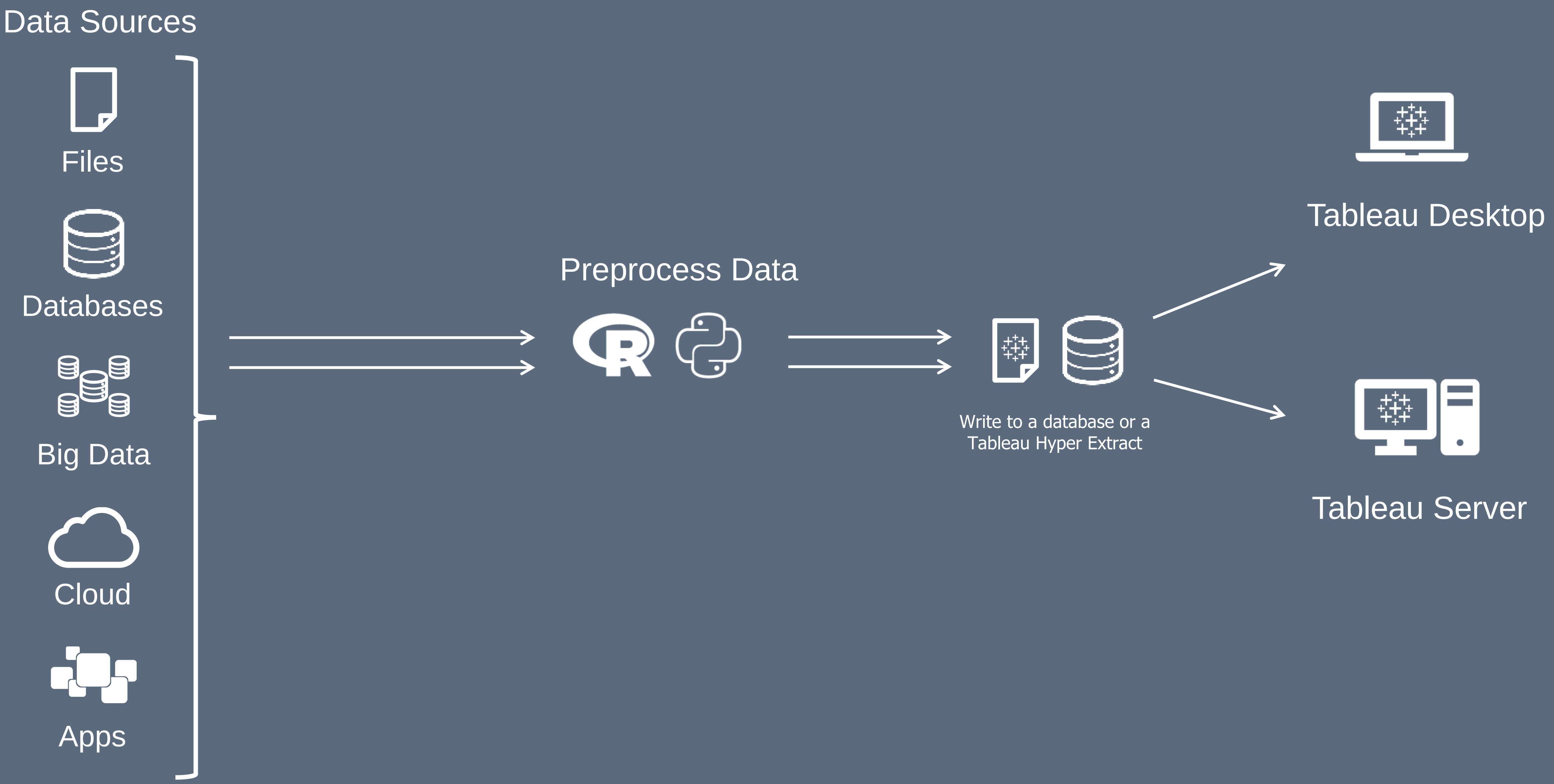
RServe

TabPy

R code

Python code

Preprocessing the data



External Services

TabPy

The TabPy server allows for the remote execution of Python code
It has two components:

- A server process built on Tornado, which allows for the remote execution of Python code through a set of REST APIs.
- A tools library that enables the deployment of such endpoints, based on Python functions

https://github.com/tableau/TabPy/blob/master/docs/about.md

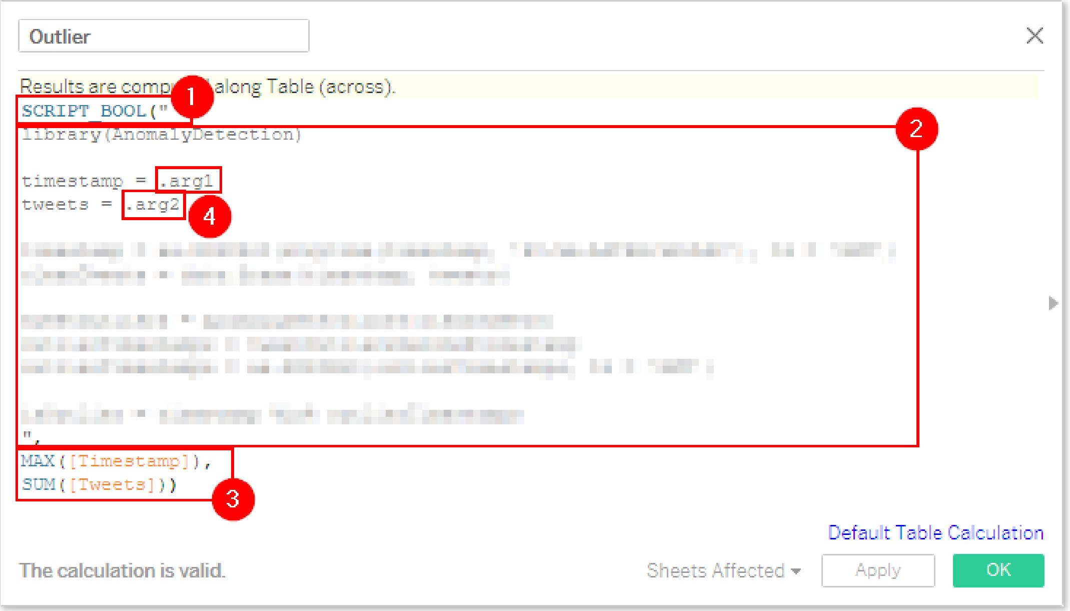
RServe

Rserve is a TCP/IP server which allows other programs to use facilities of R from various languages without the need to initialize R or link against R library.

- Rserve supports remote connection, authentication and file transfer.

https://www.rforge.net/Rserve/

SCRIPT_*() functions in Tableau



Results are comp along Table (across).

```
SCRIPT_BOOL("
library(AnomalyDetection)

timestamp = .arg1
tweets = .arg2

[redacted]

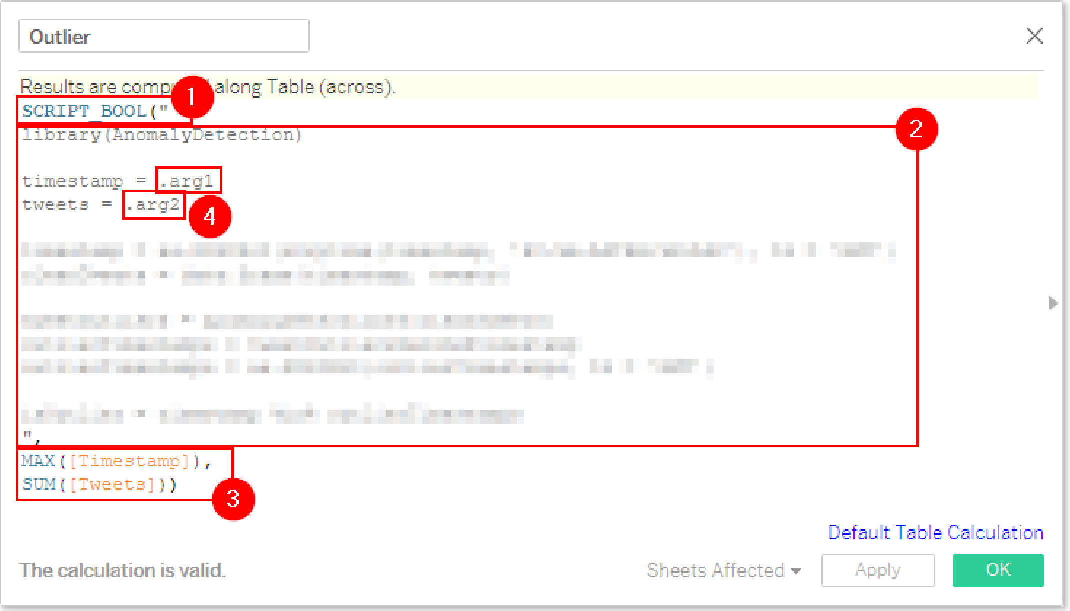
[redacted]

[redacted]
",
MAX([Timestamp]),
SUM([Tweets]))
```

The calculation is valid.

1. **Functions telling Tableau to use an external service.**
   - SCRIPT_REAL() returns real or decimal numbers
   - SCRIPT_INT() returns integers or whole numbers
   - SCRIPT_STR() returns strings (words and text)
   - SCRIPT_BOOL() returns Booleans (true/false)
]

SCRIPT_*() functions in Tableau



Outlier

Results are computed along Table (across).

```
SCRIPT_BOOL("
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timestamp = .arg1
tweets = .arg2

[redacted]

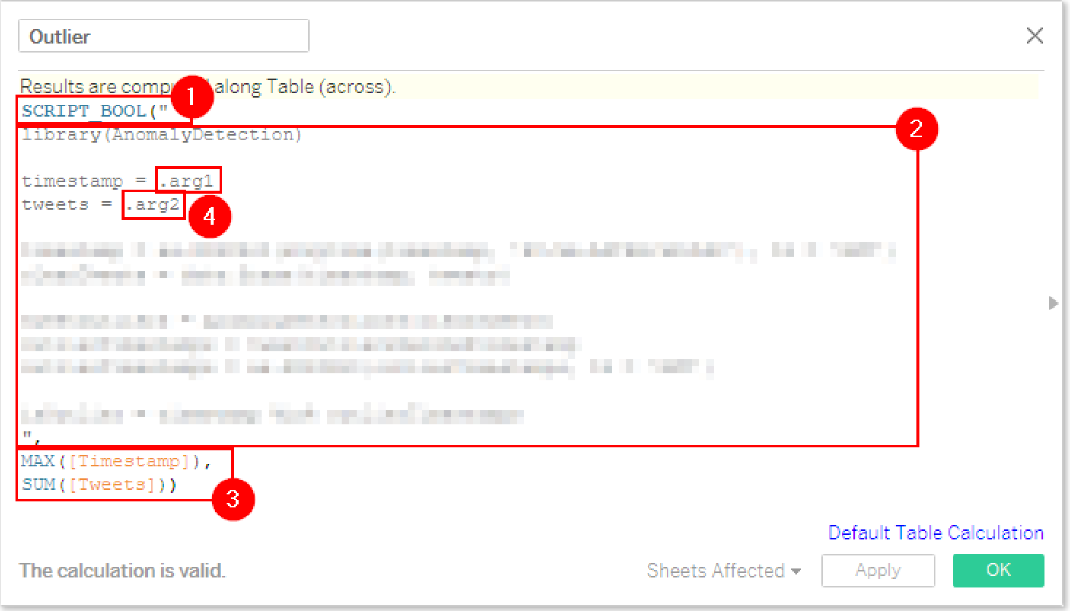
[redacted]

[redacted]
",
MAX([Timestamp]),
SUM([Tweets]))
```

The calculation is valid.

2. **The actual R / Python code to be executed.**
   - Tableau treats this as a string, sends it to Rserve / TabPy to interpret

SCRIPT_*() functions in Tableau



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[redacted]

[redacted]

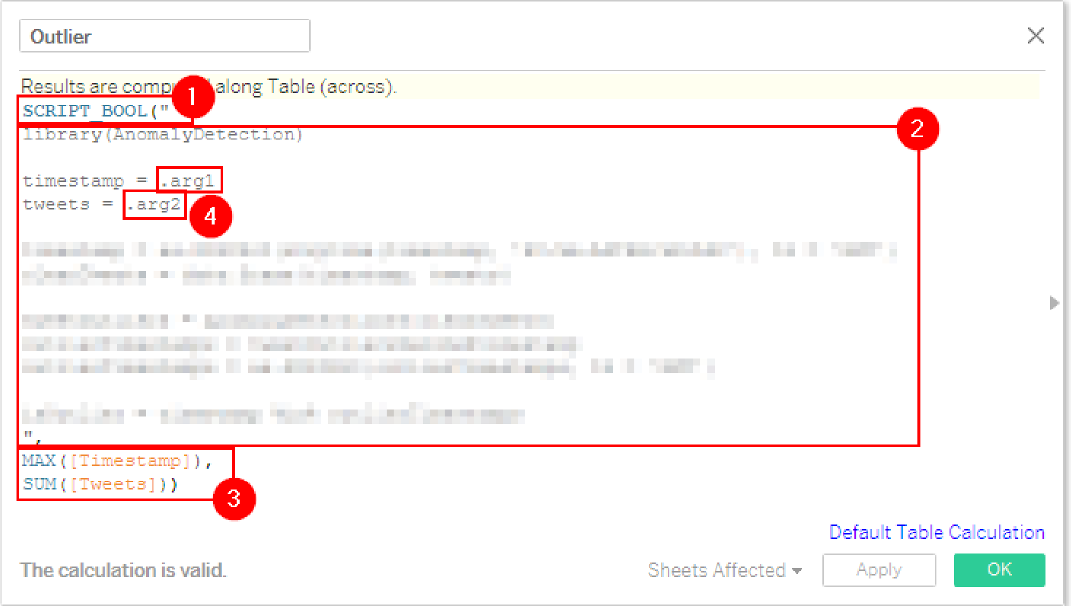
[redacted]
",
MAX([Timestamp]),
SUM([Tweets]))
```

The calculation is valid.

3. **The data from Tableau.**
   - As many arguments as needed
   - Can be [fields] or [parameters]
   - All fields must be aggregated

     MIN(), MAX(), SUM(), etc.

SCRIPT_*() functions in Tableau



Results are comp along Table (across).

```
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timestamp = .arg1
tweets = .arg2

[redacted]

[redacted]

[redacted]
",
MAX([Timestamp]),
SUM([Tweets]))
```

The calculation is valid.

4. **The data from Tableau is passed in the code as arguments**
   - arg1, arg2, arg3, etc. indicates where to put the data into the code
   - In example on the left .arg1 = MAX([Timestamp]), .arg2 = SUM([Tweets])
   - R: .arg1, .arg2, etc.
   - Python: _arg1, _arg2, etc.

The Nuts and Bolts

Installing TabPy

1. Install Python

2. Install TabPy
   - `pip install tabpy-server`

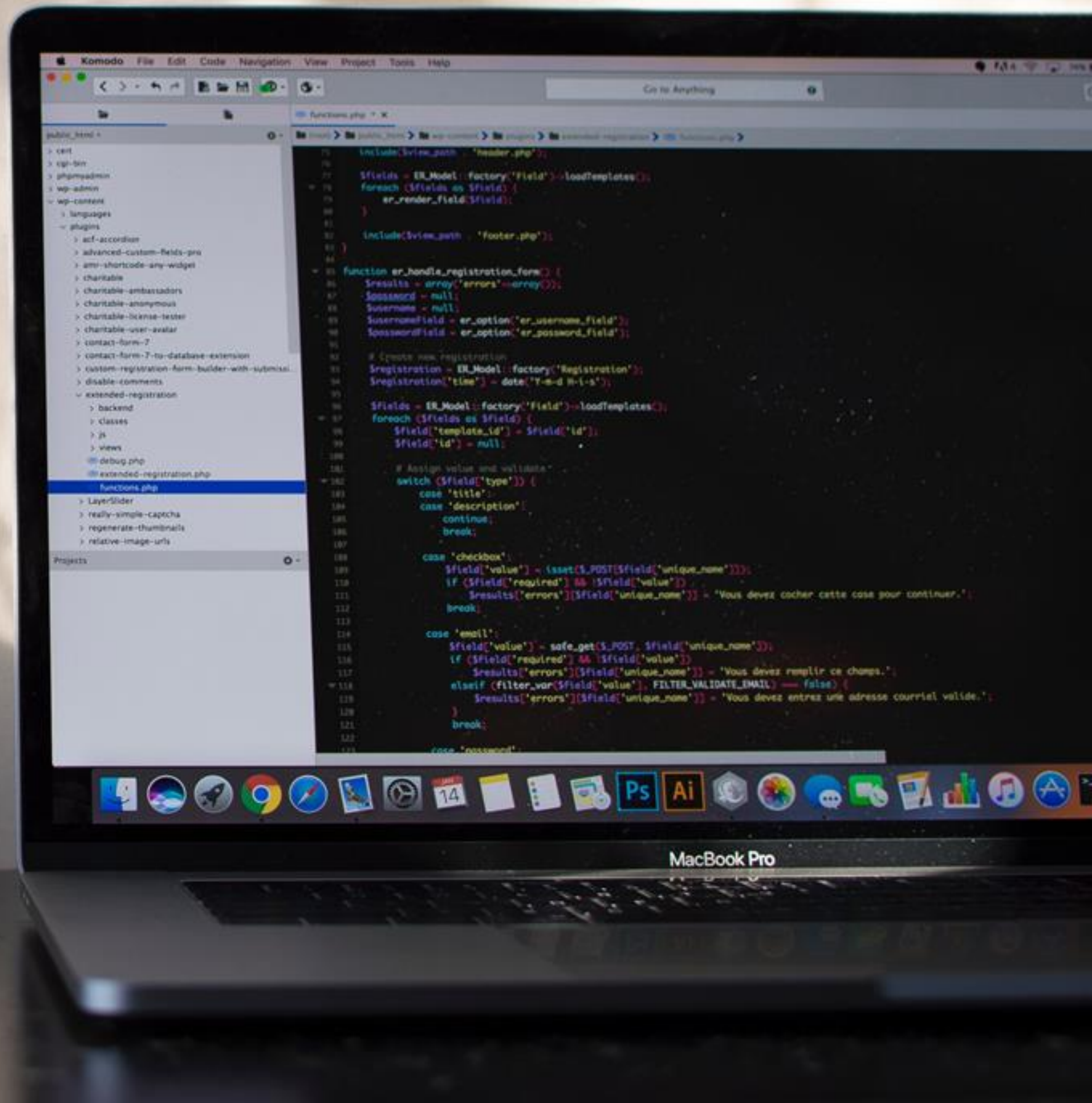
1. Install required python modules
   - `python -m pip install numpy scipy pandas statsmodels patsy sklearn nltk`

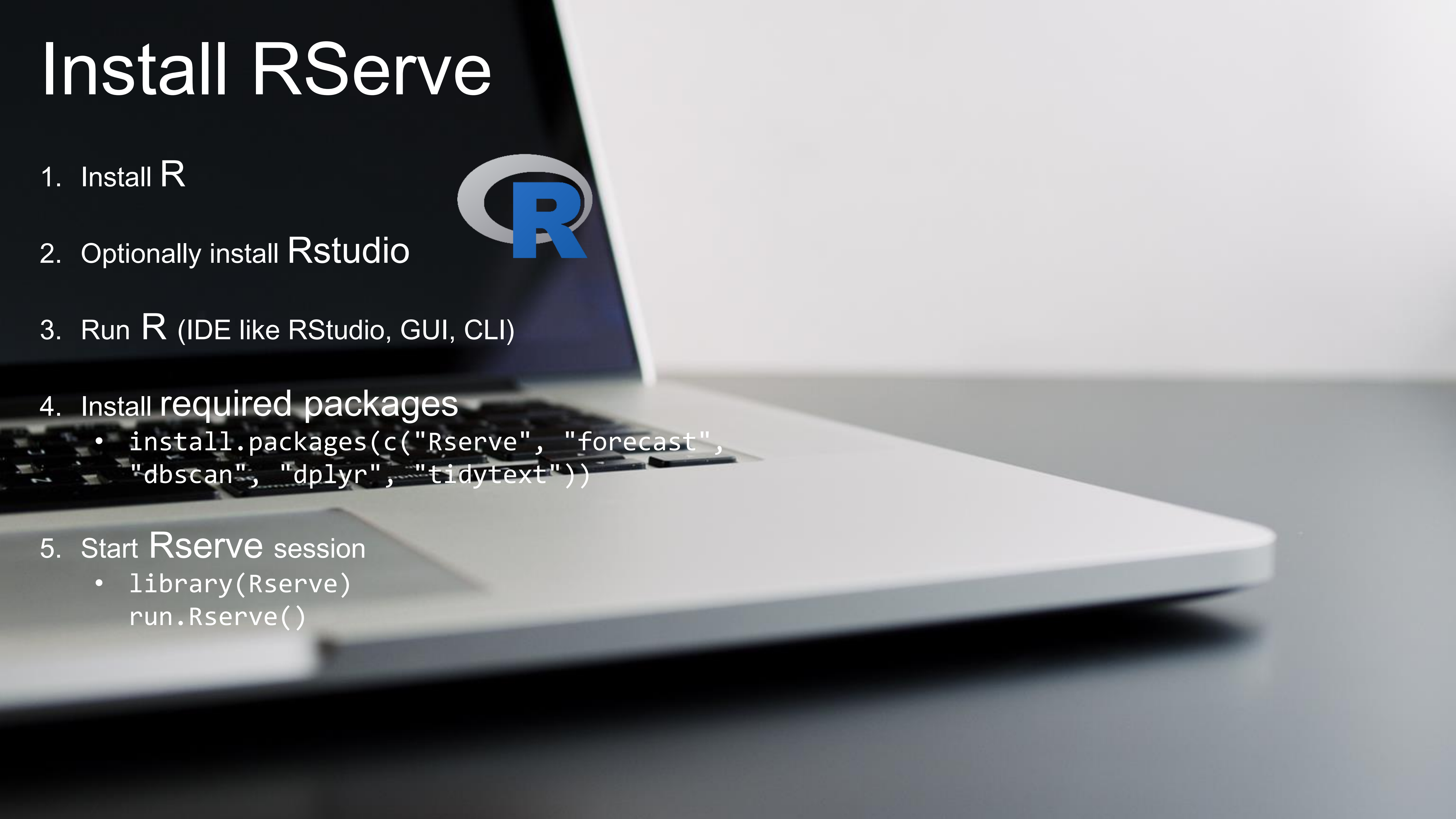
2. Initialize sentiment lexicon on Python console

   -
     ```
     import nltk
     nltk.download('vader_lexicon’)
     ```

3. Start Tabpy from the command line

More details on the install can be found on Github.





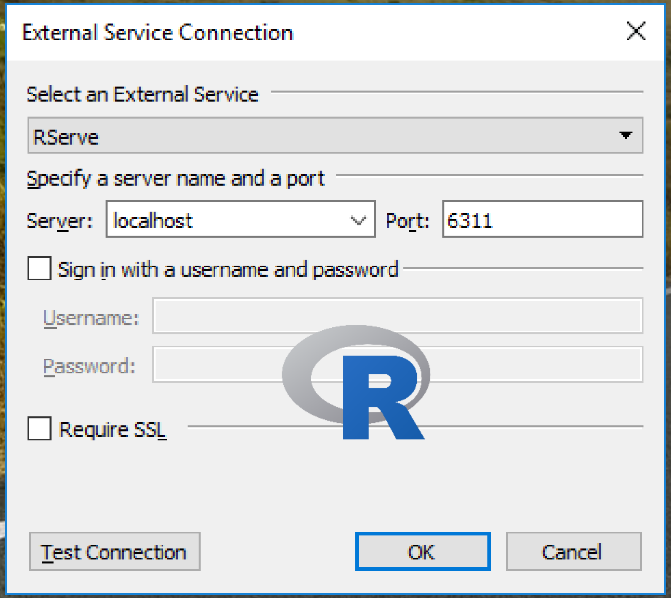
Install RServe

1. Install R
2. Optionally install Rstudio
3. Run R (IDE like RStudio, GUI, CLI)
4. Install required packages

   -
     ```
     install.packages(c("Rserve", "forecast",
     "dbscan", "dplyr", "tidytext"))
     ```
5. Start Rserve session

   -
     ```
     library(Rserve)
     run.Rserve()
     ```

Connect Tableau Desktop to Rserve / TabPy



External Service Connection

Select an External Service: RServe

Specify a server name and a port

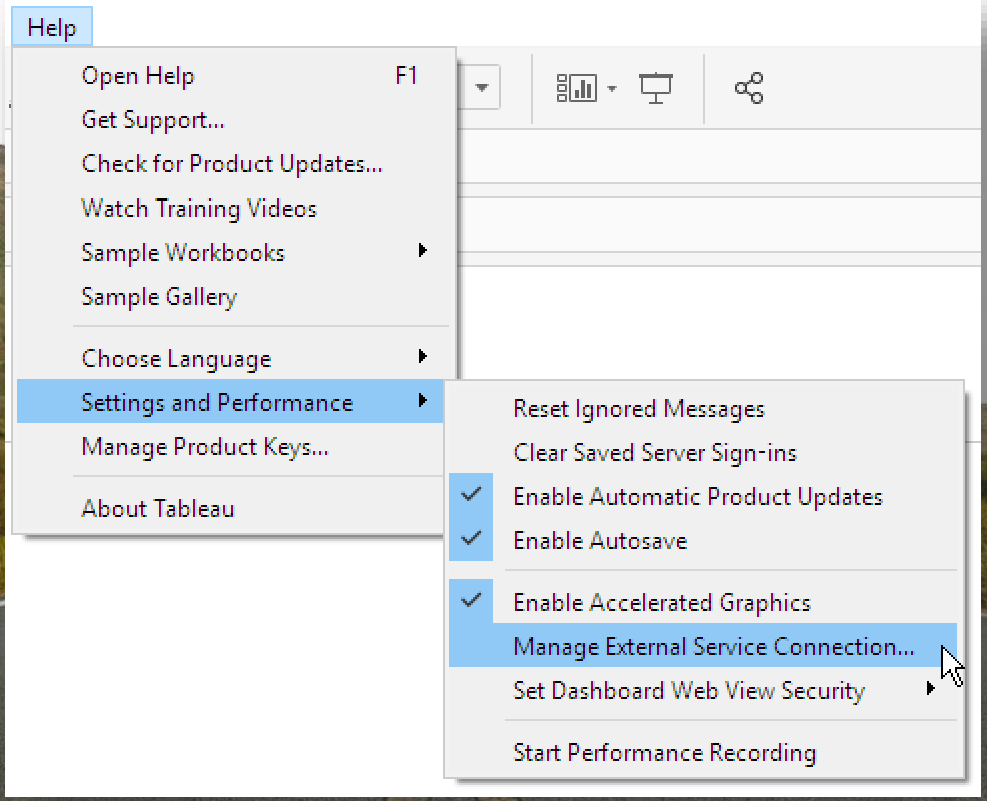
Server: localhost   Port: 6311

☐ Sign in with a username and password

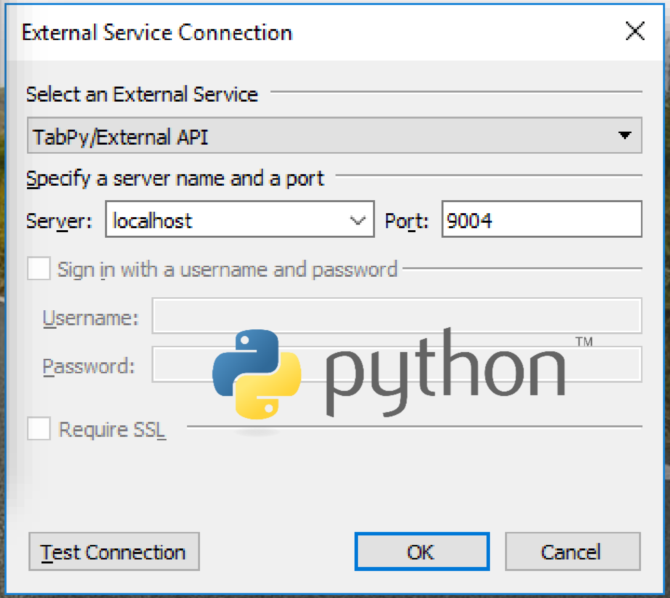
Username:

Password:

☐ Require SSL



Help
Open Help F1
Get Support...
Check for Product Updates...
Watch Training Videos
Sample Workbooks
Sample Gallery
Choose Language
Settings and Performance
Manage Product Keys...
About Tableau
Reset Ignored Messages
Clear Saved Server Sign-ins
✓ Enable Automatic Product Updates
✓ Enable Autosave
✓ Enable Accelerated Graphics
Manage External Service Connection...
Set Dashboard Web View Security
Start Performance Recording



External Service Connection

Select an External Service: TabPy/External API

Specify a server name and a port

Server: localhost   Port: 9004

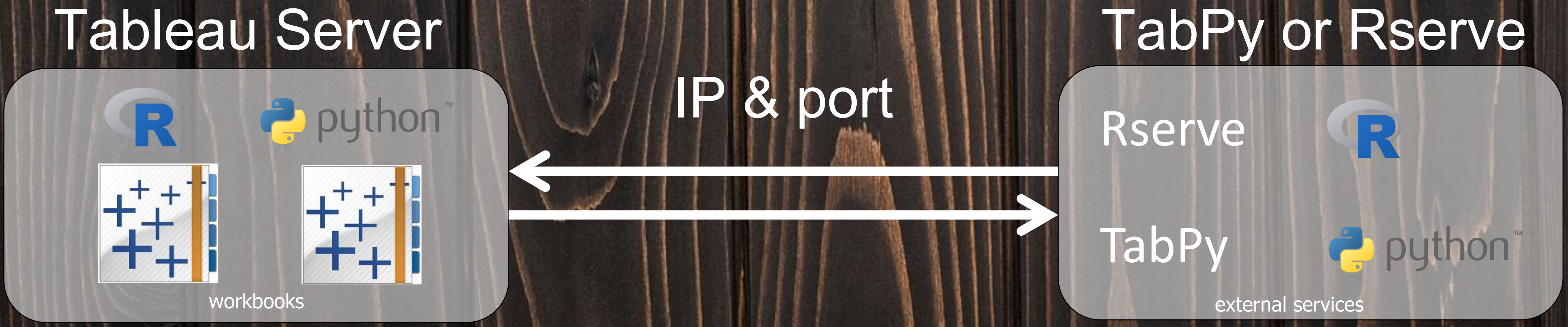
☐ Sign in with a username and password

Username:

Password:

☐ Require SSL

Connect Tableau Server to Rserve / TabPy



```
tsm configuration set -k vizqlserver.extsvc.host -v <IP>

tsm configuration set -k vizqlserver.extsvc.port -v <port>
```

Additional Considerations

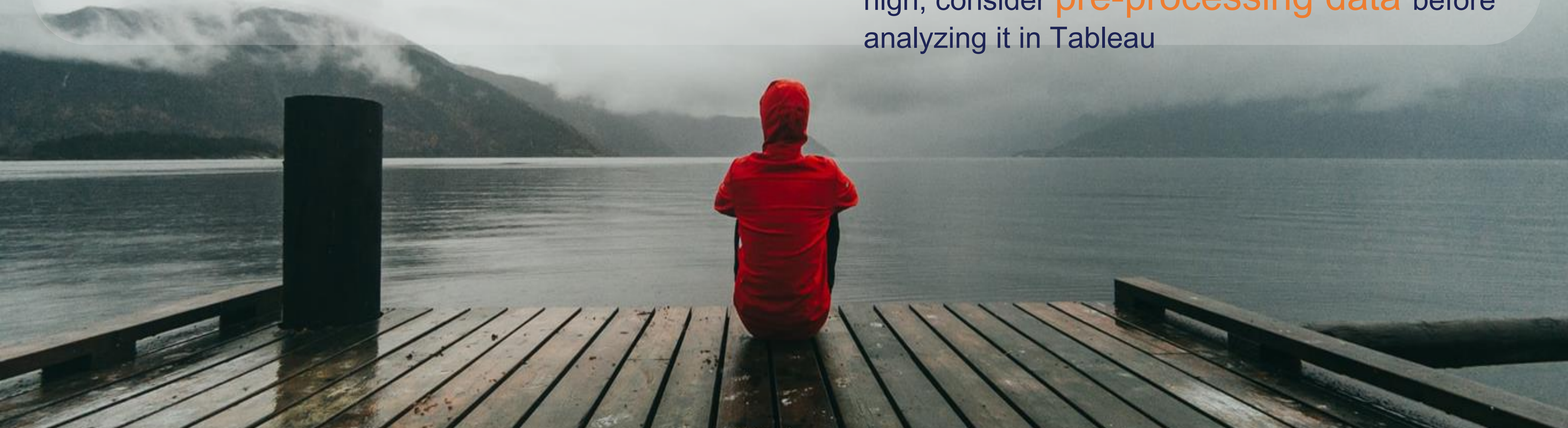
Additional Considerations

1. Tableau Desktop and Server currently only support one External Service

2. No support for External Services with Tableau Online and Tableau Public

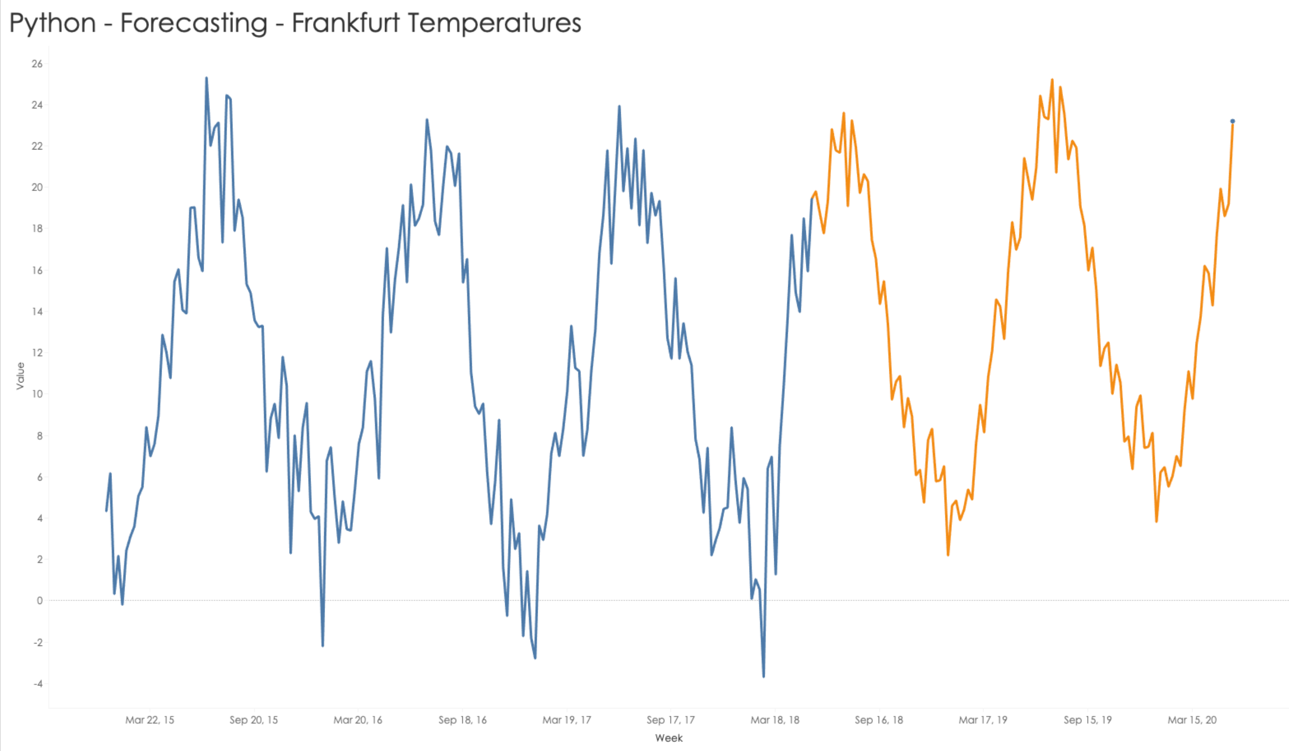
3. Security and best practices require putting External Services on a separate machine and limiting access

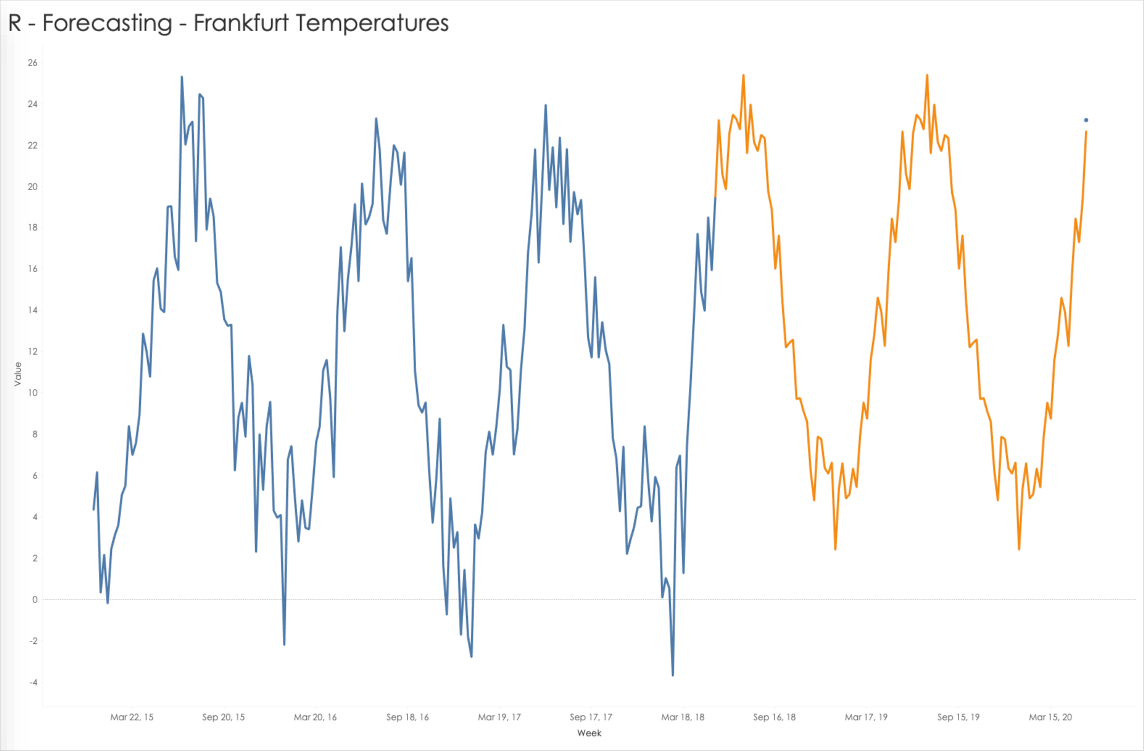
4. If latency for calculation processing times are high, consider pre-processing data before analyzing it in Tableau



Use Cases

Forecasting Time Series Data


Python - Forecasting - Frankfurt Temperatures


R - Forecasting - Frankfurt Temperatures

Forecasting Time Series Data

```
SCRIPT_REAL("
library(forecast)

inputData = na.omit(.arg1)
startDate = as.Date(min(na.omit(.arg2)))

timeSeries = ts(inputData,
                start = startDate,
                deltat = 1/52)

timeSeriesForecast = forecast(timeSeries,
                              h = length(.arg1) -
                                  length(inputData),
                              level = 95)

append(inputData,
       timeSeriesForecast$mean)
",
AVG([Temperature]),
MAX([forecastWeek]))
```

```
SCRIPT_REAL("
import numpy as np
import pandas as pd
from statsmodels.tsa.holtwinters import ExponentialSmoothing

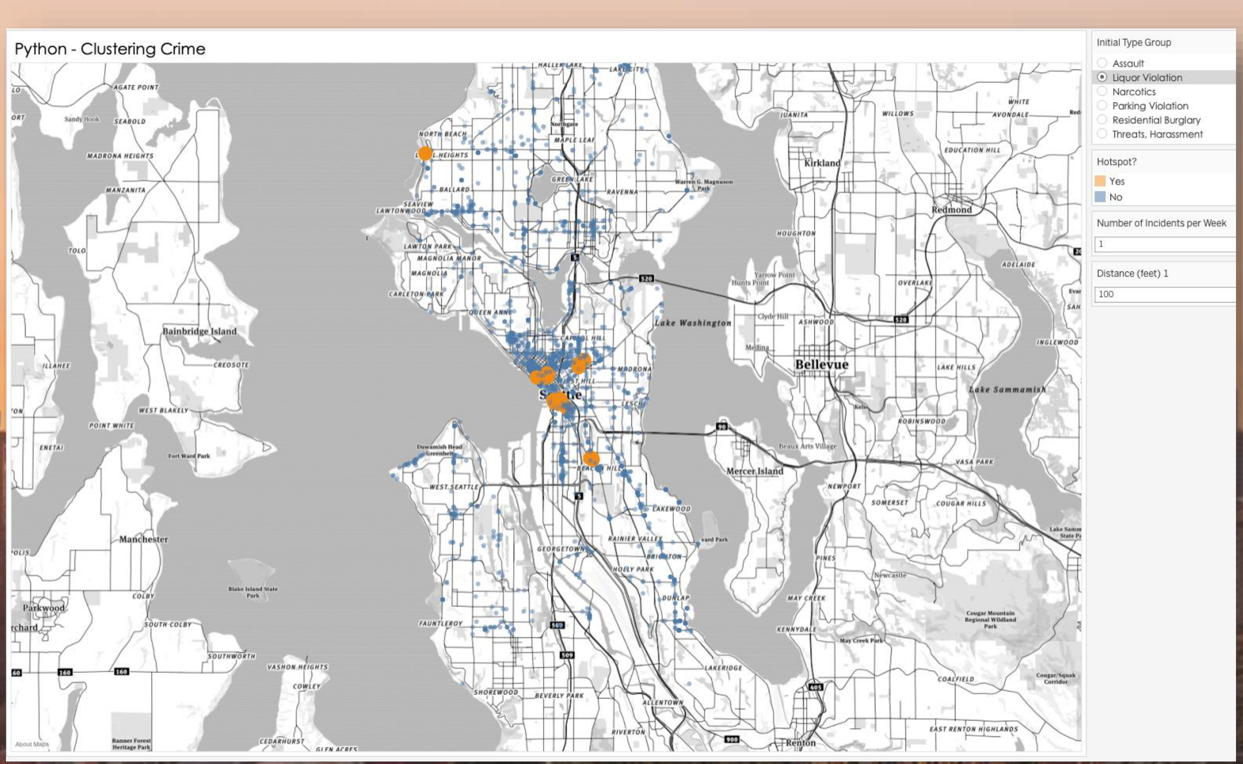
series = pd.DataFrame.from_items([('ts', _arg1), ('y',
_arg2)])
last_week = np.where(pd.isnull(series))[0][0]
weeks_to_forecast = len(series) - last_week

model_fit = ExponentialSmoothing(series.iloc[:last_week, 1],
seasonal_periods=52, trend='add', seasonal='add').fit()

yhat = model_fit.forecast(weeks_to_forecast)

return np.concatenate([series.iloc[:last_week, 1],
yhat]).tolist()
",
AVG([Temperature]),
MAX([forecastWeek]))
```

Clustering Crime



Python - Clustering Crime

Initial Type Group

○ Assault
● Liquor Violation
○ Narcotics
○ Parking Violation
○ Residential Burglary
○ Threats, Harassment

Hotspot?

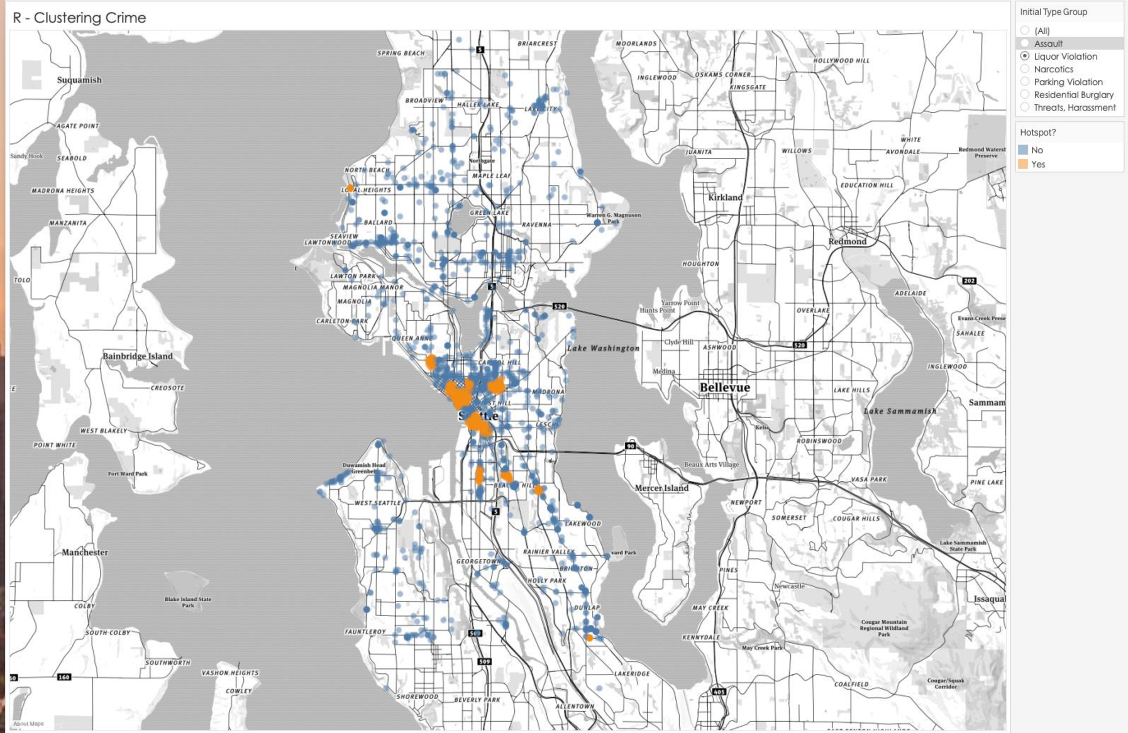
🟧 Yes
🟦 No

Number of Incidents per Week

1

Distance (feet) 1

100



R - Clustering Crime

Initial Type Group

○ (All)
○ Assault
● Liquor Violation
○ Narcotics
○ Parking Violation
○ Residential Burglary
○ Threats, Harassment

Hotspot?

🟦 No
🟧 Yes

Clustering Crime

```
SCRIPT_STR("
library(dbscan)

data <- cbind((.arg1 * pi) / 180, (.arg2 * pi) / 180)

db <- dbscan(data,
             eps = 1/39590,
             minPts = .arg3[1])$cluster

db[db > 0] <- 'Yes'
db[db == 0] <- 'No'

db
",
AVG([Latitude]),
AVG([Longitude]),
AVG([Incident Count]))
```

```
SCRIPT_STR("
import numpy as np
from sklearn.cluster import DBSCAN

X = np.column_stack([np.radians(_arg1),np.radians(_arg2)])

db = DBSCAN(eps=_arg3[1], min_samples=_arg4[1],
metric='haversine').fit(X)

return np.where(db.labels_ == np.array(-1), \
                'No', 'Yes').tolist()
",
AVG([Latitude]),
AVG([Longitude]),
[Distance between incidents]
AVG([Incident Count]))
```

DEMO

Thank You

tableau