PASS VIRTUAL SUMMIT 2020

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Introduction to Python!

Jamey Johnston

Sr. Data Scientist/Engineer

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Jamey Johnston

Dog Dad

Sr. Data Scientist/Engineer

/jameyj

@STATCowboy

Texas A&M - MS in Analytics

LSU - BS in Spatial Analysis

Blog

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Code

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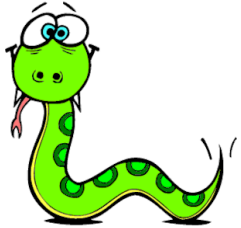
Agenda

- Introduction to Python
- Anaconda / IDEs
- Comments, Numbers and Strings
- Lists, Tuples and Dictionaries
- Pandas
- Control Flows
- Functions
- Packages
- Python and Microsoft
- Demos

Source: https://www.python.org/community/logos/

Introduction to Python



Why Python?

- Expansive Open Source Library of Data Science Tools (Giant Ecosystem)
- Easy language for new programmers
- Microsoft Support in tools like Azure Databricks, Azure Function Apps, Azure Machine Learning, SQL Server 2017+, Microsoft Machine Learning Server
- You can code on a Raspberry Pi (Who doesn't like Pi!)
- The most popular program languages (IEEE Language Rankings 2019 #1)
- Interpreted language, saves you time, no compilation and linking is necessary
- Super Fast!

Anaconda

Source: http://www.anaconda.com

Anaconda

https://www.anaconda.com/download/

Download the 64-bit Python 3.7 version (still can setup Python 3.x environments)

You can use miniconda if you don't want the full environment.

(I have switched to it).

https://docs.conda.io/en/latest/miniconda.html

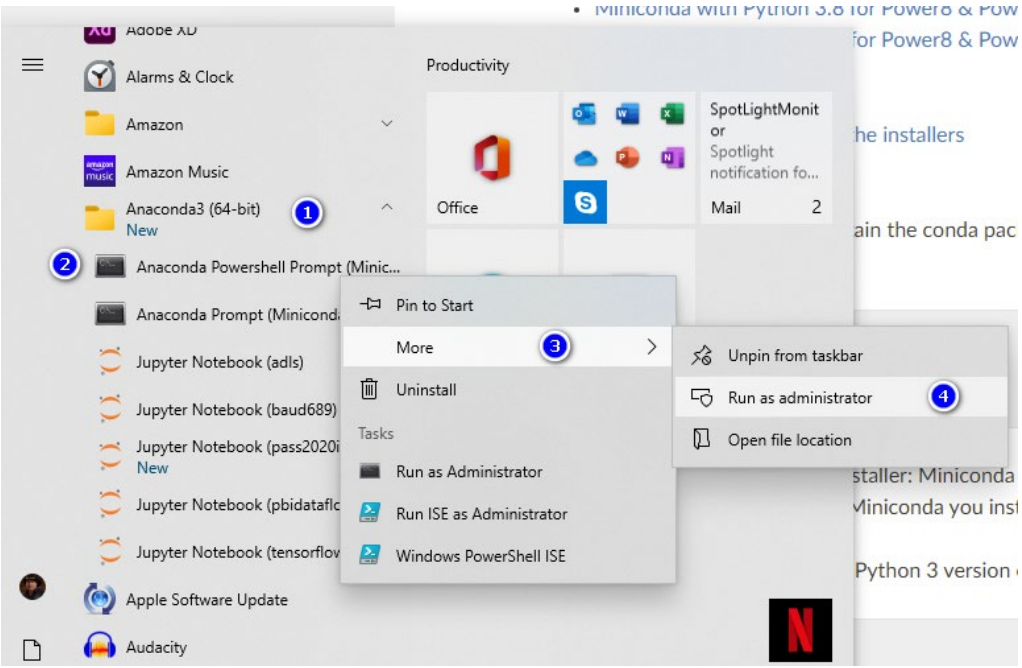
Anaconda

Conda

Open Source Package Management System
and Environment Management System

Launch the “Anaconda Prompt” as Administrator to Manage Anaconda Environment

Anaconda Prompt



Anaconda

Conda Commands

- Upgrade All Anaconda
  - `conda update --all`
  - `conda update -n <env> --all`
- Setup New Environment (e.g. Python 3.7)
  1. `conda create --name python37 python=3.7`
  2. `conda activate python37`
  3. Install Packages (few examples below)
     - `conda install seaborn`
     - `conda install pylint`
     - `conda install notebook`
     - `conda install scikit-learn`

Anaconda

Conda Commands

- List Environments
  - `conda env list`
  - * indicates active environment
- List Packages in Environment
  - `conda list`
- Remove an Environment
  - `conda env remove --name deleteme`
- Update Package
  - `conda update PACKAGENAME`

https://docs.conda.io/projects/conda/en/4.6.0/_downloads/52a95608c49671267e40c689e0bc00ca/conda-cheatsheet.pdf

Anaconda

Conda Commands

- Export Conda Environment to YAML file to build a new environment
  - `conda env export > <filename>.yml`
  - * activate the environment to export first
- Create Conda environment from YAML file
  - `conda env create -f <filename>.yml –n <ENV NAME>`

https://docs.conda.io/projects/conda/en/latest/user-guide/tasks/manage-environments.html

Packages

conda

Anaconda Distribution package manager (Use conda if using Anaconda)
Generally, try conda first before pip but always look at the package instructions first.

```
conda install pyodbc
```

pip

PyPA recommended tool for installing Python packages
Some packages are not in the conda repository (e.g. latest tensorflow packages)

```
pip install tensorflow
```

Packages

Popular Packages

PACKAGE	DETAILS
pandas	High performance, easy use data structures and analysis (DataFrames)
pyodbc	Open Source Python Module for ODBC data sources
matplotlib	2D Plotting library
scikit-learn	Simple tool for data mining and data analysis / statistics
numpy	N-dimensional arrays, linear algebra, random numbers
SciPy	Math, Stats, Science and Engineering package
tensorflow	Google library to train and develop ML models
keras	High-level neural networks API. Runs on top of TensorFlow, CNTK and Theano

DEMO

Conda & Packages

Python IDE

PyCharm

https://www.jetbrains.com/pycharm/

Spyder

Included in Anaconda Distribution

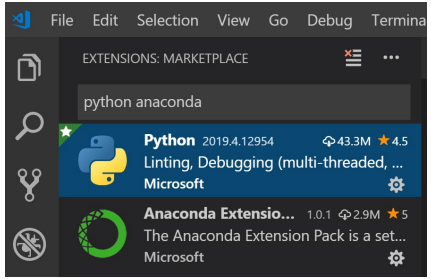
Visual Studio Code

https://code.visualstudio.com/docs/languages/python
https://code.visualstudio.com/docs/python/python-tutorial
https://marketplace.visualstudio.com/items?itemName=ms-python.python

Visual Studio Code

VS Code Python Shortcuts

https://code.visualstudio.com/docs/python/python-tutorial

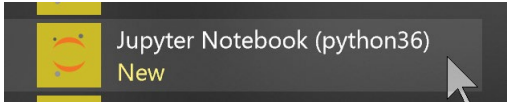


- Command Palette (CP) – `Ctl+Shift+P`
- Select Python Interpreter (in CP) – `Python: Select Interpreter`
- Run Selection/Line in Python Terminal – `Shift+Enter`
- Install pylint for Highlighting Syntax – `conda install pylint (run in all env)`
- Install Python and Anaconda Extensions
- IPython console support in Python Interactive window

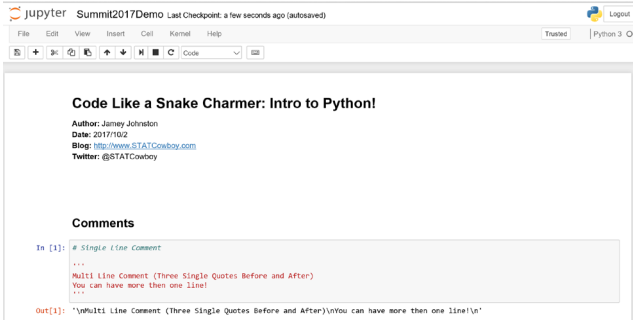
Jupyter Notebooks

Computer Code and Rich Text

http://jupyter-notebook.readthedocs.io/en/latest/



- Activate desired environment first
- Then to Start a Notebook – `jupyter notebook`



DEMO

IDE / Tools

Comments

Single Line Comment

- Pound Sign/Hash is used for single line comments

```
# Single Line Comment
```

Multi-Line Comment

' ' ' - Three single-quotes before and after the comments

```
'''
Multi Line Comment (Three Single Quotes Before and After)
You can have more then one line!
'''
```

Numbers

Operators “+, -, * and / “ as you would expect!

```
taxRate = 8.25 / 100
price = 100
tax = price * taxRate
finalPrice = price + tax
print('Tax: ${:,.2f}'.format(tax))
print('Final Price: ${:,.2f}'.format(finalPrice))

Tax: $8.25
Final Price: $108.25
```

Strings

single quotes ('...') or double quotes ("...")

```
simpleString = 'This is a simple string!'
print(simpleString)
simpleStringDouble = “This is a simple string!”
print(simpleStringDouble)
This is a simple string!
This is a simple string!
```

Strings

Escape with “\”

```
print('Isn\'t Pass Summit Virtual!')
Isn't Pass Summit Virtual!
```

Strings

Repeat Strings with "*" and Concatenate with "+"

```
espn = 3*'duh '+' (we still wish MJ was playing!)  '+3*'duh '
print(espn)

duh duh duh  (we still wish MJ was playing!)  duh duh duh
```

Strings

Slicing/Indices on Strings

Positive indexes start at 0 and Negative start with -1

```
passSummit = 'PASS Summit 2020'

+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
| P | A | S | S |   | S | u | m | m | i | t |   | 2 | 0 | 1 | 9 |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
  0   1   2   3   4   5   6   7   8   9  10  11  12  13  14  15  16
-16 -15 -14 -13 -12 -11 -10  -9  -8  -7  -6  -5  -4  -3  -2  -1
```

Strings

Important Notes

Strings are Immutable (i.e. you can't change them)

`len()` – will return the length of the string

Lists

Compound Data Type

Used to group values together.

Comma-separated values/items enclosed by square brackets.

List can contain different types of data but usually they contain the same types.

```
myList = [1,2,3,4]
```

Lists

Slice and Index List

```
myList[0]
myList[-3:] # slicing returns a new list
```

Concatenate Lists

```
myNewList = myList + [5,6,7,9]
```

Lists

List are mutable (you can change them!)

```
myNewList[7] = 8
```

Append to a List

```
myNewList.append(9)
```

Lists

Replace a slice (even with a different size)

```
myNewList[2:4] = [1,1]
```

Length of list

```
len(myNewList)
```

Tuples

Number of Values Separated by Commas

```
t = 'PASS', 'Summit', ‘2020'
```

Tuples may be Nested

```
nt = t, ('is', 'awesome', '!')
```

Tuples

Tuples are Immutable

```
t[2] = ‘2020’  # Will throw an error!
```

Dictionaries

Unordered key/value pairs

```
yearBirth = {'jamey': 1974, 'melanie': 1975, 'jeanna': 1989, ‘robyn': 1979}
```

Delete item in Dictionary

```
del yearBirth['robyn']
```

Dictionaries

List Keys (unordered)

```
list(yearBirth.keys())
```

List Keys (sorted/ordered)

```
sorted(yearBirth.keys())
```

Pandas

Series and DataFrame

Labeled Array Data Structures

Input/output Tools (CSV, Excel, ODBC)

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

NumPy

Homogeneous Multidimensional Array

N-dimensional arrays, linear algebra, random numbers

https://numpy.org/devdocs/user/quickstart.html

Indention (i.e. Copy/Paste don't work!)

Indention

Indention is used to indicate the scope of a block of code (like { … } in other languages)
Blank lines do not affect indention, Same as Comments on a line by themselves

Word of CAUTION: Turn OFF Tabs!!!

If you copy and paste from the internet your indentions will more than likely be Tabs!
Python cares a great deal about indention! You will get "indention errors" if not right.

Control Flows

Conditionals / Comparisons

PYTHON CODE	RESULT
==	Equal To
!=	Not Equal To
<	Less Than
<=	Less Than or Equal To
>	Greater Than
>=	Greater Than or Equal To

If … Elif (i.e. Then) … Else

if … elif … else

```
n = 5
m = 10
if n < 10 and m <  10:
    print('n and m are single digit numbers!')
elif n >= 10 and m < 10:
    print('n is a big number and m is a single digit number!')
elif n < 10 and m >= 10:
    print('n is a single digit number and m is a big number!')
else:
    print('n and m are big number!')
```

If and In

IN Operator on List

```
if 2 in [1, 2, 3, 4]:
    print('Found it!')
else:
    print('Keep looking!')
```

For Loops

for Loops

```
for i in [1, 2, 3, 4]:
    print(i)

wordList = ['Jamey', 'Melanie', 'Stefanie', 'Robyn']
for word in wordList:
    print('Family member name:', word)
```

For and Range

Range Function

```
r = range(5)
print(r)
for num in r:
    print(r[num])
```

For and Zip

Loop over two or more lists

```
questions = ['name', 'birth year', 'occupation']
answers = ['Jamey Johnston', '1974', 'Data Scientist']
for q, a in zip(questions, answers):
    print('What is your {0}?  It is {1}.'.format(q, a))
```

For Loop and Dictionaries

Retrieve Key/Value of List in Loop, Sorted by Key

```
yearBirth = {'jamey': 1974, 'melanie': 1975, 'jeanna': 1989}
for k, v in sorted(yearBirth.keys()):
    print(k, 'was born in the year ', v)
```

Break, Continue, Else in Loops

break, continue and else

```
for n in range(2, 10):
    for x in range(2, n):
        if n % x == 0:
            print(n, 'equals', x, '*', n//x)
            break
    else:
        # loop fell through without finding a factor
        print(n, 'is a prime number’)
```

https://docs.python.org/3/tutorial/controlflow.html#break-and-continue-statements-and-else-clauses-on-loops

Try Statements

break and continue … try and except, pass and finally, too

```
while True:
    txt = input('Enter number (integers only!):')
    try:
        integer = int(txt)
    except:
        print('Please enter integer only!')
        continue
    print('You entered the integer,', integer)
    break
print('Done!')
```

While Loops

while Loops

```
num = 0
while num < 10:
    print(num)
    num = num+1
```

Functions

Simple Function

```
# NOTE: non-default parameters must be first!
def greetSummit(year, name=None):
    if name is not None:
        print('Welcome to PASS Summit ', year, ', ', name, '!', sep='')
    else:
        print('Welcome to PASS Summit ', year, '!', sep='')

greetSummit(2020)
greetSummit(2020, 'Jamey')
```

Classes/Objects

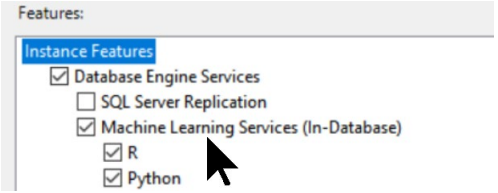
Simple Class and Objects

```
class Database:
    def __init__(self, instance):
        self.instance = instance

    def mssql(self, version):
        print(self.instance + " is MSSQL version " + version + " and is Clustered!")

    def oracle(self):
        print(self.instance + " is Oracle and has crashed! Call Larry!")

def main():
    prod = Database("prod")
    prod.oracle()
    dev = Database("dev")
    dev.mssql("2020")

if __name__ == "__main__":
  main()
```

DEMO

Python Demos

Python and Microsoft SQL Server 2017+



sp_execute_external_script

Executes Python via T-SQL in MSSQL 2017+

Install Machine Learning Services (In-Database)

Anaconda Distribution installed with MLS

New revoscalepy library – scale and performance

Executes outside the SQL Server process

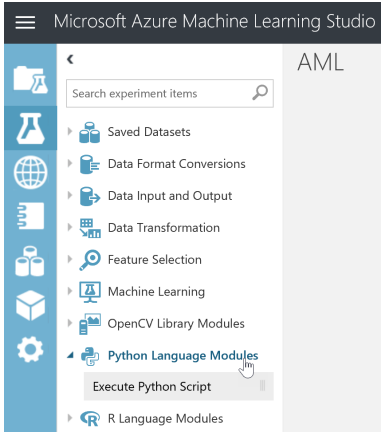
Data returned as a pandas data frame

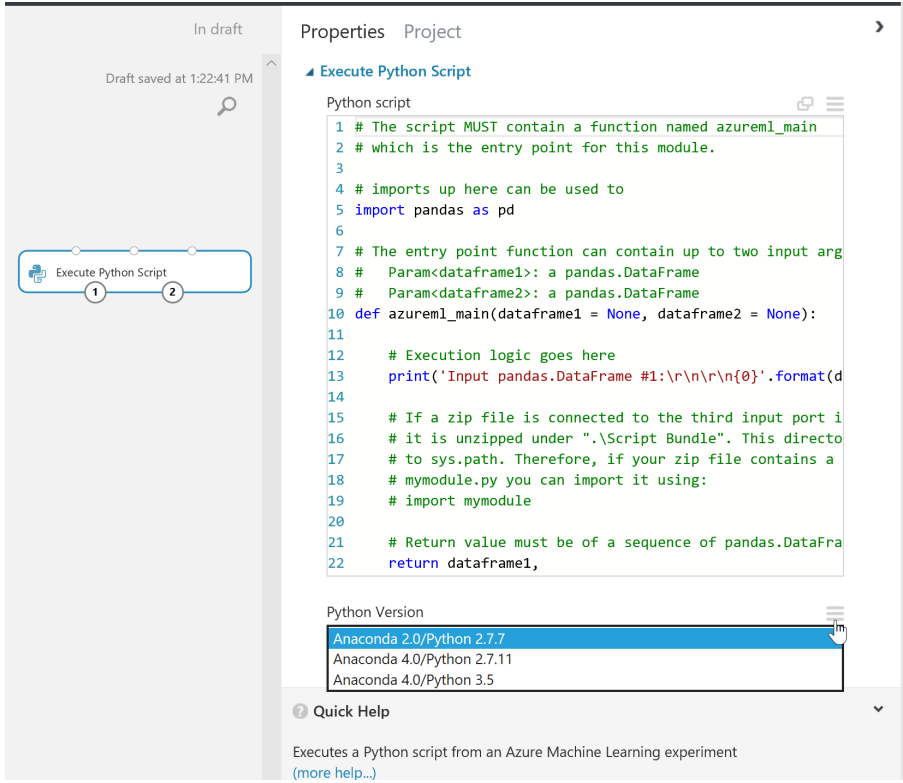
Also, supports R

```
sp_execute_external_script
    @language = N'language' ,
    @script = N'script',

    @input_data_1 = ] 'input_data_1'
    [ , @input_data_1_name = ] N'input_data_1_name' ]
    [ , @output_data_1_name = 'output_data_1_name' ]
    [ , @parallel = 0 | 1 ]
    [ , @params = ] N'@parameter_name data_type [ OUT | OUTPUT ] [ ,...n ]'
    [ , @parameter1 = ] 'value1' [ OUT | OUTPUT ] [ ,...n ]
    [ WITH <execute_option> ]
[;]

<execute_option>::=
{
      { RESULT SETS UNDEFINED }
    | { RESULT SETS NONE }
    | { RESULT SETS ( <result_sets_definition> ) }
}

<result_sets_definition> ::=
{
    (
         { column_name
           data_type
         [ COLLATE collation_name ]
         [ NULL | NOT NULL ] }
         [,...n ]
    )
    | AS OBJECT
        [ db_name . [ schema_name ] . | schema_name . ]
        {table_name | view_name | table_valued_function_name }
    | AS TYPE [ schema_name.]table_type_name
}
```

Python and Azure Machine Learning

Execute Python Script





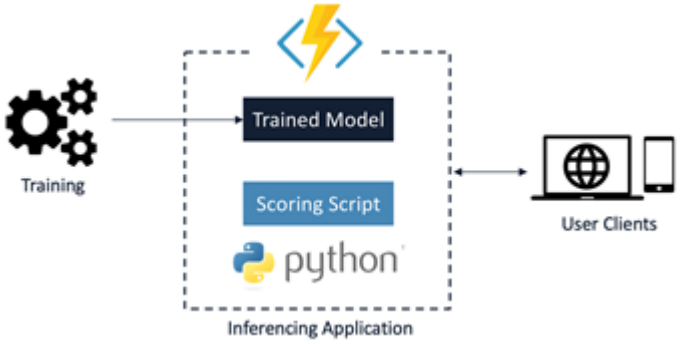
Python and Azure App Sevices

Web Apps on a Fully Managed Platform

https://azure.microsoft.com/en-us/services/app-service/

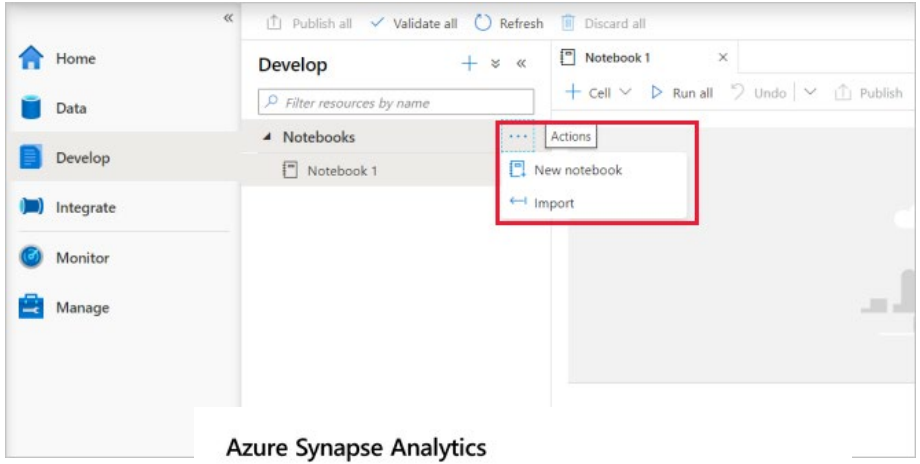
Python and Azure Functions

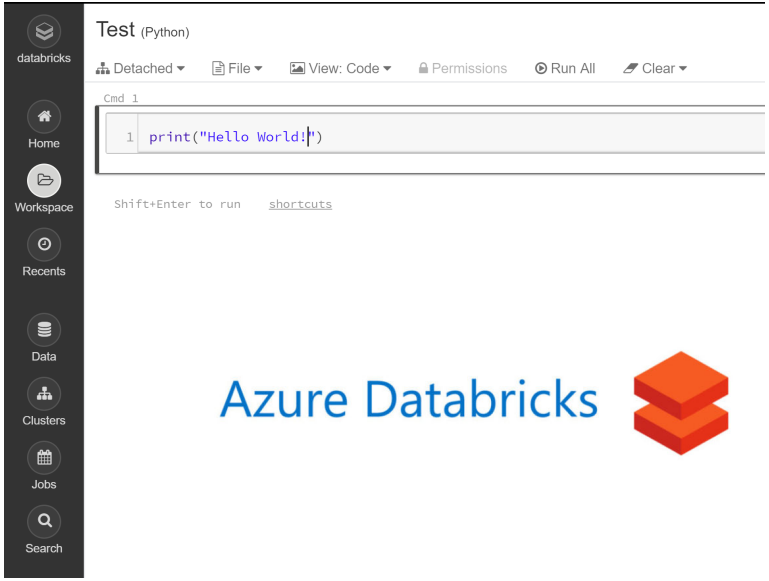
Serverless Compute Platform



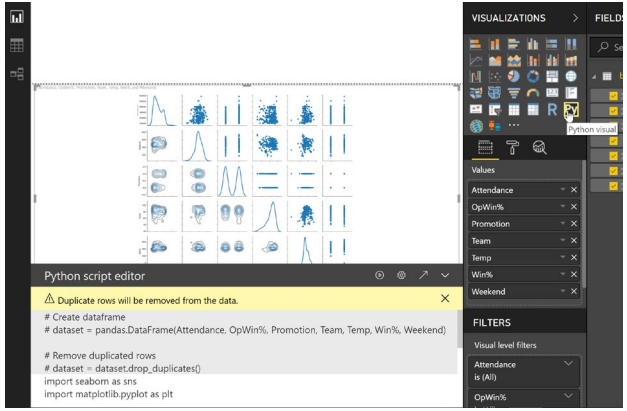
https://azure.microsoft.com/en-us/services/functions/
https://azure.microsoft.com/en-us/blog/announcing-the-general-availability-of-python-support-in-azure-functions/

Python & Azure Synapse Analytics & Databricks

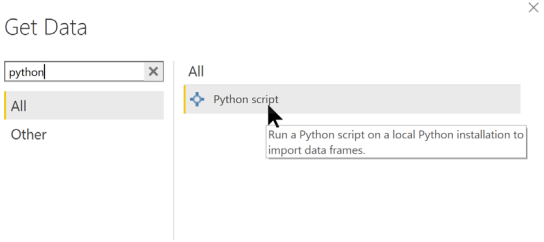


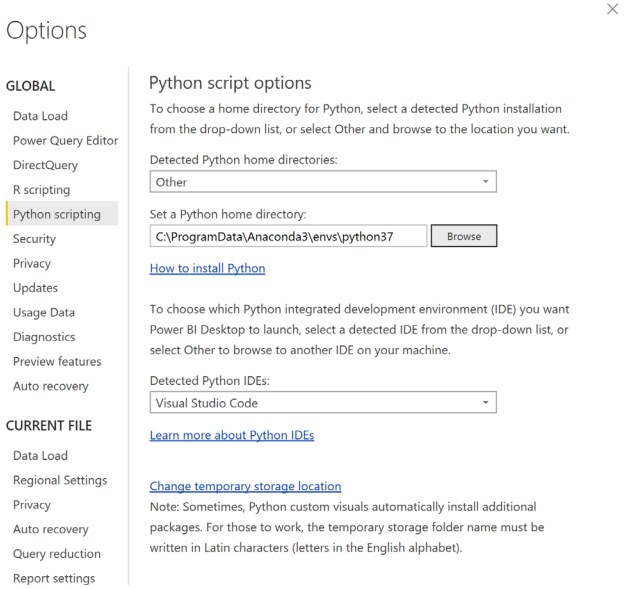


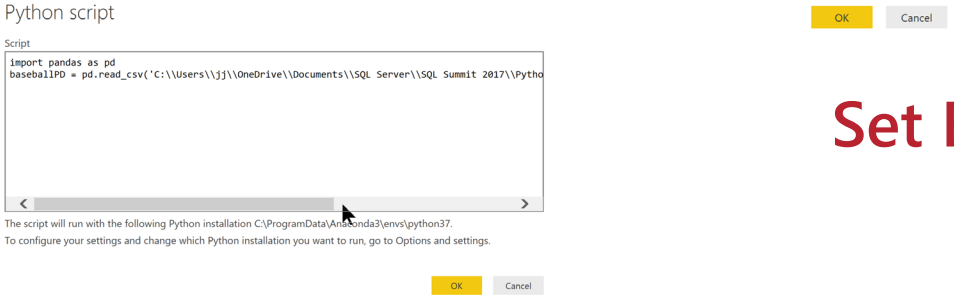
Python and Power BI



Visuals/Scripts





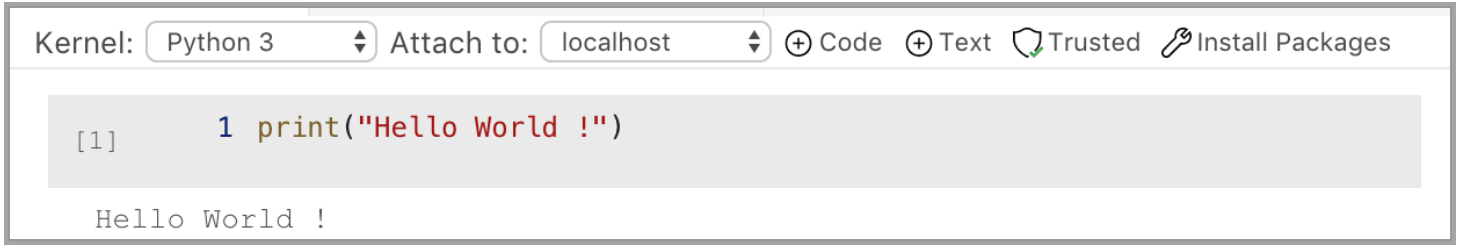


Set Env

Python and Azure Data Studio

Run Python in Azure Data Studio

- https://docs.microsoft.com/en-us/sql/azure-data-studio/notebooks/notebooks-python-kernel?view=sql-server-ver15



References

Python Docs

https://docs.python.org/3/reference/introduction.html

Coursera

https://www.coursera.org/specializations/python

MS Academy

https://academy.microsoft.com/en-us/professional-program/tracks/data-science/

References

The Hitchhiker's Guide to Python!

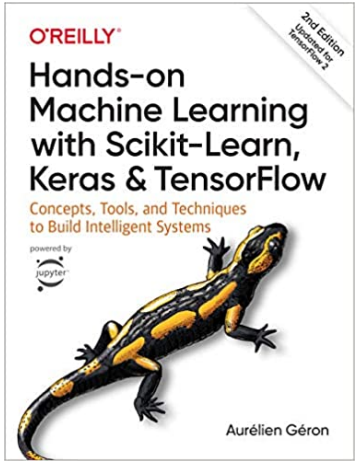
http://docs.python-guide.org/en/latest/

Google

https://developers.google.com/edu/python/?hl=en

Good Book

Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems 2nd Edition



Thank you

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