



Introduction to Python for Data Science

资料科学入门 – 使用Python程序语言 Numpy & Pandas

June 2020

Microsoft Reactor | Ryan Chung

```
led by player to  
s.load_image("kg.png")  
  
[self]:  
    initialize Dog object and create Text o  
g, self).__init__(image = Dog.image  
x = games.mouse.x  
bottom = games.sc  
  
re = games.Text(value = 0, size = 24  
top = 5, right = gam  
  
reen.add(self.score)  
1 = games.Text(value = 0, size = 24  
top = 5, left = gam
```



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Reactor



developer.microsoft.com/reactor/
@MSFTReactor on Twitter

Data Science Workshop agenda 资料科学在线研讨会议程

Getting started with NumPy and Pandas

NumPy与Pandas入门

19:30	Welcome 开场
19:35	NumPy Arrays 数组操作(建立/索引/转型/切割/排序)
20:10	Aggregations 整体分析
20:30	10-minute break 中场休息
20:40	Pandas Data Structures Pandas 数据结构 - 序列与DataFrame
21:20	Data Operations 数据操作(转换/取出/合成/缺失值填补)
21:30	Event end 研讨会结束

NumPy 入门 Numerical Python

Section 2 第二节

Section 2 overview 第二节综览

- Built-in help 温馨提示
- NumPy arrays
 - Creating 建立
 - Attributes 属性
 - Indexing 索引
 - Reshaping 重塑转型
 - Splitting and joining 切割与组合
 - Fancy indexing 选择性取出
 - Sorting 排序
- Aggregations

Section 2 overview 第二节综览

为什么要使用NumPy?

- 使用快速，函数已编译过
- 标准数学函数库，适合资料科学
- 是很多热门函数库(如pandas)的根基



美国洛杉矶市使用NumPy来预测
房客遭遇非法驱逐的可能性

VS Code 温馨提示

自动带出可使用的方法

```
HelloNumpy.py > ...
1 import numpy as np
2 np.
```

- str
- { stride_tricks
- { sys
- { test
- { testing
- { tests
- { twodim_base
- { type_check
- { ufunclike
- { umath
- { umath_tests
- unicode

Python Interactive

Variables

Name

No variables

点击 ⓘ 进一步了解

```
HelloNumpy.py > ...
1 import numpy as np
2 np.
```

- str ⓘ
- { stride_tricks
- { sys
- { test
- { testing
- { tests
- { twodim_base
- { type_check
- { ufunclike
- { umath
- { umath_tests
- unicode

Python Interactive

Variables

Name

No variables

进一步了解...Ctrl+Space

str(bytes_or_buffer, encoding=None, errors=None)

str(object='') -> str
str(bytes_or_buffer[, encoding[, errors]]) -> str

Create a new string object from the given object. If encoding or errors is specified, then the object must expose a

NumPy arrays – 给予Python List来建立

09.hello_numpy.py > ...

```
1 import numpy as np
2 myList = [True, "Bob", 3.0, 4]
3 myListTypeList = [type(item) for item in myList]
4
5 myArray = np.array([True, "Bob", 3.0, 4])
6 myArrayTypeList = [type(item) for item in myArray]
```

List串行很自由
可以住不同人种(资料型态)

NumPy Array 军事化管理
全部统一人种(资料型态)

Python Interactive X



Jupyter Server: local Python 3:

Variables

Name	Type	Count	Value
myArray	ndarray	4	['True' 'Bob' '3.0' '4']
myArrayTypeList	list	4	[<class 'numpy.str_'>, <class 'numpy.str_'>, <class 'numpy.str_'>, <class 'numpy.str_'>]
myList	list	4	[True, 'Bob', 3.0, 4]
myListTypeList	list	4	[<class 'bool'>, <class 'str'>, <class 'float'>, <class 'int'>]

NumPy VS. Python List 运行时间比较

```
import numpy as np
```

```
my_list = list(range(1000000))
```

```
%time my_list2 = [x*2 for x in my_list]
```

Wall time: 86.8 ms

```
my_arr = np.array(my_list)
```

```
%time my_arr = my_arr*2
```

Wall time: 2.95 ms

```
[0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26 <...> , 999988, 999989, 999990, 999991, 999992, 999993, 999994, 999995, 999996, 999997, 999998, 999999]
```

my_list

```
[ 0  1  2 ... 999997 999998 999999]
```

my_arr

10

NumPy的算术运算

- 跟单一常数做运算

```
import numpy as np
```

```
arr = np.array([[1,2,3],[4,5,6]])  
arr.dtype
```

```
[[1 2 3]  
 [4 5 6]]
```

1/arr

```
array([[1.         , 0.5         , 0.33333333],  
       [0.25        , 0.2         , 0.16666667]])
```

arr**0.5

```
array([[1.         , 1.41421356, 1.73205081],  
       [2.         , 2.23606798, 2.44948974]])
```

NumPy的算术运算

- 强项：整批运算，无须for loop

```
import numpy as np
```

```
arr = np.array([[1,2,3],[4,5,6]])
```

```
arr.dtype
```

```
arr*arr
```

$$\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix} \times \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix} = \begin{bmatrix} 1 & 4 & 9 \\ 16 & 25 & 36 \end{bmatrix}$$

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NumPy的算术运算

- 两个数组进行比较，产出布尔数组

```
import numpy as np
```

```
arr = np.array([[1,2,3],[4,5,6]])  
arr2 = np.array([[0,4,1],[7,2,12]])
```

```
arr > arr2
```

```
[[1 2 3]  
 [4 5 6]]
```

arr

```
[[ 0  4  1]  
 [ 7  2 12]]
```

arr2

```
array([[ True, False,  True],  
       [False,  True, False]])
```

NumPy array 阵列建立与常用属性

🔗 Numpy_3D.py > ...

产生介于0~9的随机数

```
1 import numpy as np
2 a3 = np.random.randint(10, size=(3,4,5))
3 print(a3.ndim) 维度
4 print(a3.shape) 形状 (3 x 4 x 5) – 每个维度的元素个数
5 print(a3.size) 元素个数
```

```
3
(3, 4, 5)
60
```

#限定随机数起讫范围的写法(20~30)

```
a4 = np.random.randint(20,31, size=(3,4,5))
```

Variables

Name	Type	Count
a3	ndarray	3

```
[[[9 5 4 5 3]
  [6 0 8 7 4]
  [1 0 9 9 3]
  [7 9 6 1 9]]

 [[0 3 9 1 9]
  [5 2 7 6 3]
  [4 3 9 0 5]
  [3 0 8 1 6]]

 [[1 2 0 9 1]
  [8 4 8 0 1]
  [6 0 4 4 8]
  [9 1 8 4 3]]]
```

10.numpy_3d.py

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NumPy 建立内容全为0的数组

```
import numpy as np  
zero_array = np.zeros(10)  
zero_2d_array = np.zeros((3,6))
```

```
[0. 0. 0. 0. 0. 0. 0. 0. 0. 0.]
```

zero_array

```
[[0. 0. 0. 0. 0. 0.]  
 [0. 0. 0. 0. 0. 0.]  
 [0. 0. 0. 0. 0. 0.]]
```

zero_2d_array

NumPy 数据型态观察

- dtype : 数据型态
- astype : 数据型态转换

```
import numpy as np
```

```
float_array = np.array([1.0, 2.0, 3.0, 4.0, 5.0])  
float_array.dtype
```

[1. 2. 3. 4. 5.] dtype('float64')

```
int_array = float_array.astype(np.int32)  
int_array.dtype
```

[1 2 3 4 5] dtype('int32')

NumPy 常用数据型态 / 代码			
int32 / i4	int64 / i8	bool / ?	object / O
float32 / f4	float64 / f8	string_ / S10	unicode_ / U

自定义长度

NumPy array 索引取值

randomWithNumpy.py > ...

```
1 import numpy as np
2 np.random.seed(0) 放了数字会固定
3 a1 = np.random.randint(10, size=6)
```

产生0~9的乱数共6个

Variables

Name	Type	Count	Value
a1	ndarray	6	[5 0 3 3 7 9]

0	1	2	3	4	5
5	0	3	3	7	9

```
print(a1[0])
```

```
print(a1[2])
```

```
print(a1[4])
```

```
print(a1[1])
```

```
print(a1[3])
```

```
print(a1[5])
```

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11.random_with_numpy.py

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NumPy array 索引赋值

```
import numpy as np
np.random.seed(0)
a1 = np.random.randint(10, size=6)
a1[1:4]=2 #影响第1,2,3个元素
```

Variables

Name	Type	Count	Value
a1	ndarray	6	[5 0 3 3 7 9]



Variables

Name	Type	Count	Value
a1	ndarray	(6,)	[5 2 2 2 7 9]

0	1	2	3	4	5
5	0	3	3	7	9

0	1	2	3	4	5
5	2	2	2	7	9

NumPy array 索引赋值

```
import numpy as np
np.random.seed(0)
a1 = np.random.randint(10, size=6)
a1[1:4]=2 #影响第1,2,3个元素
a1[:] = 0 #影响所有元素
```

Variables

Name	Type	Count	Value
a1	ndarray	(6,)	[0 0 0 0 0 0]

0	1	2	3	4	5
0	0	0	0	0	0

NumPy array: slicing array 阵列切割

slicingArray.py > ...

```
1 import numpy as np
2 a = np.arange(10)
3 print(a[4:7])
```

回传从 0(预设起始值)~9(结束值-1)的数字

取出阵列部分元素变成另一个阵列

12.slicing_array.py

Variables

Name	Type	Count	Value
a	ndarray	10	[0 1 2 3 4 5 6 7 8 9]

[4 5 6]



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NumPy array: reshaping 重塑转型

reShaping.py > ...

```
1 import numpy as np
2 originalArray = np.arange(1,10)
3 reshapingArray = originalArray.reshape((3,3))  重塑成 3 x 3
```

Python Interactive X



Variables

Name	Type	Count	Value	
originalArray	ndarray	9	[1 2 3 4 5 6 7 8 9]	
reshapingArray	ndarray	3	[[1 2 3] [4 5 6] [7 8 9]]	

```
[[1 2 3]
 [4 5 6]
 [7 8 9]]
```

13.reshaping.py

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NumPy array 九宫格取值练习

[[1	2	3]
[4	5	6]
[7	8	9]]

第0列跟第1列的第1个元素跟第2个元素

`reshapingArray[:, 1:]`

NumPy array 九宫格取值练习

`[[1 2 3]`

`[4 5 6]`

`[7 8 9]]`

第2列的所有元素

`reshapingArray[2]`

`reshapingArray[2, :]`

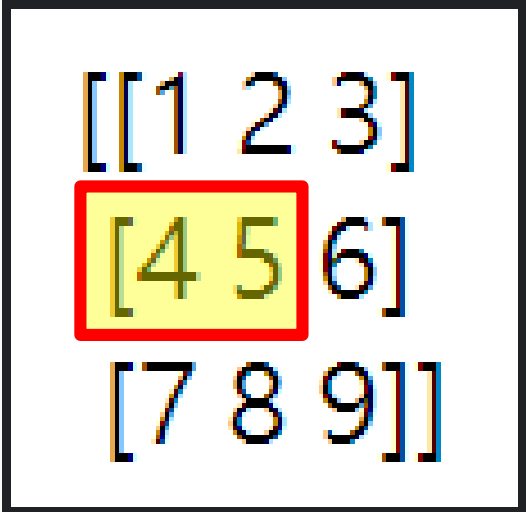
NumPy array 九宫格取值练习

1	2	3
4	5	6
7	8	9

每1列的第0个元素跟第1个元素

`reshapingArray[:, :2]`

NumPy array 九宫格取值练习



```
[[1 2 3]
 [4 5 6]
 [7 8 9]]
```

第1列的第0个元素跟第1个元素

`reshapingArray[1, :2]`

NumPy array: joining 组合

```
import numpy as np
array_one = np.array([1,2,3])
array_two = np.array([4,5,6])
array_combine = np.concatenate([array_one, array_two])
array_add = array_one + array_two
array_2d = np.array([array_one, array_two])
```

[1 2 3 4 5 6]

array_combine

[5 7 9]

array_add

[[1 2 3]
[4 5 6]]

array_2d

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NumPy array 九宫格取值练习

[[1	2	3]
	[4	5	6]
	[7	8	9]]

第0列的第0个元素跟第1个元素

與

第2列的第0个元素跟第1个元素

```
np.array([reshapingArray[0, :2],  
          reshapingArray[2, :2]])
```

NumPy array: splitting 切割

均分成3份

```
1 import numpy as np
2 array_one = np.array([1,2,3])
3 array_two = np.array([4,5,6])
4 array_three = np.concatenate([array_one, array_two])
5 array_four, array_five, array_six = np.split(array_three,3);
```

array_three	ndarray	6	[1 2 3 4 5 6]
array_four	ndarray	2	[1 2]
array_five	ndarray	2	[3 4]
array_six	ndarray	2	[5 6]

[x,y] -> [:2] , [2,3], [3:]

```
1 import numpy as np
2 array_one = np.array([1,2,3])
3 array_two = np.array([4,5,6])
4 array_three = np.concatenate([array_one, array_two])
5 array_four, array_five, array_six = np.split(array_three,[2,3]);
```

array_three	ndarray	6	[1 2 3 4 5 6]
array_four	ndarray	2	[1 2]
array_five	ndarray	1	[3]
array_six	ndarray	3	[4 5 6]

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NumPy array: fancy indexing 选择性取出

```
selectedIndex.py > ...
1 import numpy as np
2 nameListArray=np.array(["王明","陳道","柳宇","夏恬"])
3 selectedArray = np.array(nameListArray[[2,3]])
```

Python Interactive X

Variables

Name	Type	Count	Value
nameListArray	ndarray	4	['王明' '陳道' '柳宇' '夏恬']
selectedArray	ndarray	2	['柳宇' '夏恬']

也可以写成
`np.array(nameListArray[2:])`

NumPy array: sorting 排序

由小到大

sortingArray.py > ...

```
1 import numpy as np
2 originalArray = np.array([2,1,4,3,5])
3 sortedArray = np.sort(originalArray)
```

Python Interactive X

X ↶ ↷ □ ↻ 📊 📄 📁 📂

Variables

Name	Type	Count	Value
originalArray	ndarray	5	[2 1 4 3 5]
sortedArray	ndarray	5	[1 2 3 4 5]

依特定项目进行排序

sortingArray.py > ...

```
1 import numpy as np
2 dataTypes = [('name', 'S10'), ('score', int)]
3 dataValues = [('John', 80), ('Marry', 60), ('Ryan', 90), ('Leon', 40)]
4 originalArray = np.array(dataValues, dtype=dataTypes)
5 sortedArray = np.sort(originalArray, order='score')[::-1]
```

Python Interactive X

X ↶ ↷ □ ↻ 📊 📄 📁 📂

Variables

Name	Type	Count	Value	
dataTypes	list	2	[('name', 'S10'), ('score', <class 'i	🔗
dataValues	list	4	[('John', 80), ('Marry', 60), ('Ryan'	🔗
originalArray	ndarray	4	[(b'John', 80) (b'Marry', 60) (b'Ryan	🔗
sortedArray	ndarray	4	[(b'Ryan', 90) (b'John', 80) (b'Marry	🔗

由大到小

sortingArray.py > ...

```
1 import numpy as np
2 originalArray = np.array([2,1,4,3,5])
3 sortedArray = np.sort(originalArray)[::-1]
```

Python Interactive X

X ↶ ↷ □ ↻ 📊 📄 📁 📂

Variables

Name	Type	Count	Value
originalArray	ndarray	5	[2 1 4 3 5]
sortedArray	ndarray	5	[5 4 3 2 1]

S10 : 10个字符的字符串

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16.sorting_array.py

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Aggregations 整体分析

aggregations.py > ...

```
1 import numpy as np
2 myArray = np.array([1,2,3,4,5])
3 print(sum(myArray))
4 print(myArray.min())
5 print(myArray.max())
6 print(myArray.sum())
```

加总

最小值

最大值

加总

Python Interactive X



```
15
1
5
15
```

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NumPy 综合取值练习

```
import numpy as np
name = np.array(["张山", "李洁", "王武", "陈至", "何美"])
gender = np.array(["male", "female", "male", "male", "female"])
height = np.array([172, 155, 183, 153, 168, 160])
weight = np.array([75.2, 45.6, 84.3, 72.1, 51.0])
score_math = np.array([45, 74, 62, 89, 32, 55])
score_english = np.array([92, 85, 28, 61, 78])
score_chinese = np.array([88, 55, 70, 61, 98])
```

班上的女孩儿们的名子是?

```
name[gender=="female"]
```

```
array(['李洁', '何美'], dtype='<U2')

```

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NumPy 综合取值练习

```
import numpy as np
name = np.array(["张山", "李洁", "王武", "陈至", "何美"])
gender = np.array(["male", "female", "male", "male", "female"])
height = np.array([172, 155, 183, 153, 168, 160])
weight = np.array([75.2, 45.6, 84.3, 72.1, 51.0])
score_math = np.array([45, 74, 62, 89, 32, 55])
score_english = np.array([92, 85, 28, 61, 78])
score_chinese = np.array([88, 55, 70, 61, 98])
```

班上男生的国文平均?

$$(88 + 70 + 61) / 3 = 73$$

```
score_chinese[gender!="female"].mean()
```

73.0

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NumPy 综合取值练习

```
import numpy as np
name = np.array(["张山", "李洁", "王武", "陈至", "何美"])
gender = np.array(["male", "female", "male", "male", "female"])
height = np.array([172, 155, 183, 153, 168, 160])
weight = np.array([75.2, 45.6, 84.3, 72.1, 51.0])
score_math = np.array([45, 74, 62, 89, 32, 55])
score_english = np.array([92, 85, 28, 61, 78])
score_chinese = np.array([88, 55, 70, 61, 98])
```

班上谁英文不及格?

```
name[score_english<60]
```

```
array(['王武'], dtype='<U2')
```

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pandas 简介

Section 3 第三节



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稍后请记得填写课程回馈问卷
<https://aka.ms/ReactorFeedback>

Section 3 overview 第三节综览

- Pandas 的资料结构
 - Series 序列
 - DataFrame
- 资料操作
 - 串行、序列转换
 - 取出部分
 - 序列合成
 - 缺失值填补

Section 3 overview 第三节综览

为什么要使用pandas?

- 是Python的标准函式库，专门用来处理与操作资料
- 有直观的、表格型的资料结构(DataFrame)
- 有可以快速进行资料计算与转型的方式(NumPy)
- 资料探索便利，与许多视觉化函式库紧密结合(matplotlib, seaborn)

	NumPy	Pandas
数值处理	相同数据型态	不同数据型态
常见数据形式	数组	表格式

知名线上串流服务商使用pandas与Jupyter notebook来做资料探索、准备与验证

Pandas 资料结构: Series 序列

预设index值：
0 ~ N-1 (N为资料笔数)

```
HelloPandas.py > ...  
1 import numpy as np  
2 import pandas as pd  
3 series_example = pd.Series([-0.5, 0.75, 1.0, -2])  
4 print(series_example.index)
```

Python Interactive X

[1] ▶ import numpy as np...

RangeIndex(start=0, stop=4, step=1)

Variables

Name	Type	Count	Value
series_example	Series	4	0 -0.50 1 0.75 2 1.00 3 -2.00 dtype: float64

```
0 -0.50  
1 0.75  
2 1.00  
3 -2.00  
dtype: float64
```

Pandas 资料操作: list 串行 + Index索引 -> Series 序列

```
pandas_dataIndex.py > ...  
1 import pandas as pd  
2 numberList = [-0.5, 0.75, 1.0, -2]  
3 series_example = pd.Series(numberList, index = ['a', 'b', 'c', 'd'])  
4 ind = series_example.index
```

自订index值

Python Interactive X

Variables

Name	Type	Count	Value
ind	Index	4	Index(['a', 'b', 'c', 'd'], dtype='object')
numberList	list	4	[-0.5, 0.75, 1.0, -2]
series_example	Series	4	a -0.50 b 0.75 c 1.00 d -2.00 dtype: float64

```
a -0.50  
b 0.75  
c 1.00  
d -2.00  
dtype: float64
```

Pandas 资料操作: 取出部分序列

```
pandas_dataIndex.py > ...  
1 import pandas as pd  
2 numberList = [-0.5, 0.75, 1.0, -2]  
3 series_example = pd.Series(numberList, index = ['a', 'b', 'c', 'd'])  
4 ind = series_example.index  
5 print(series_example['b'])  
6 print(series_example[0:2])
```

Python Interactive X

Variables

Name	Type	Count	Value
ind	Index	4	Index(['a', 'b', 'c', 'd'], dtype='object')
numberList	list	4	[-0.5, 0.75, 1.0, -2]
series_example	Series	4	a -0.50 b 0.75 c 1.00 d -2.00 dtype: float64

```
a -0.50  
b 0.75  
c 1.00  
d -2.00  
dtype: float64
```

```
[3] print(series_example['b'])  
0.75
```

```
[4] print(series_example[0:2])  
a -0.50  
b 0.75  
dtype: float64
```


Pandas 资料操作: 序列合成、缺失值填补

seriesAdd.py > ...

```
1 import pandas as pd
2 series1 = pd.Series([25,10,50],index=[0,1,2])
3 series2 = pd.Series([5,70,40],index=[1,2,3])
4 series3 = series1 + series2
5 series3_good = series1.add(series2, fill_value=0)
```

两个序列不对等，形成缺失值
预设将缺失值设定为0

```
0 25
1 10
2 50
dtype: int64
```

```
1 5
2 70
3 40
dtype: int64
```

```
0 NaN
1 15.0
2 120.0
3 NaN
dtype: float64
```

```
0 25.0
1 15.0
2 120.0
3 40.0
dtype: float64
```

Series1

Series2

Series3

Series3_good

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Pandas 资料操作: 用Dictionary字典来建立序列

```
DataFrame.py > ...
1 import pandas as pd
2 population_dict = {
3     'France': 65429495,
4     'Germany': 82408706,
5     'Russia': 143910127,
6     'Japan': 126922333
7 }
8 population = pd.Series(population_dict)
```

Python Interactive X

Variables

Name	Type	Count	Value
population	Series	4	France 65429495 Germany 82408706
population_dict	dict	4	{'France': 65429495, 'Germany':

```
France      65429495
Germany     82408706
Russia      143910127
Japan       126922333
dtype: int64
```

Pandas 资料操作: 用Dictionary字典来建立序列

- 依国家名称首字母进行排序

```
import numpy as np
import pandas as pd
population_dict = {
    'France':65429495,
    'Germany':82408706,
    'Russia':143910127,
    'Japan':126922333
}
```

```
population = pd.Series(population_dict)
population
```

#取出国家名称index进行排序

```
country_name_sorted = np.sort(population.index)
```

#搭配已经排序好的国家名称来建立Series

```
population_sorted = pd.Series(population_dict,country_name_sorted)
```

France	65429495
Germany	82408706
Russia	143910127
Japan	126922333

population_dict

France	65429495
Germany	82408706
Russia	143910127
Japan	126922333
dtype: int64	

population

0	France
1	Germany
2	Japan
3	Russia

country_name_sorted

France	65429495
Germany	82408706
Japan	126922333
Russia	143910127
dtype: int64	

population_sorted

Pandas 资料操作: 用Dictionary字典来建立序列

- 依人口数进行排序

```
import numpy as np
import pandas as pd
population_dict = {
    'France':65429495,
    'Germany':82408706,
    'Russia':143910127,
    'Japan':126922333
}
```

```
population = pd.Series(population_dict)
```

#取出国家名称index进行排序

```
country_name_sorted = np.sort(population.index)
```

#搭配已经排序好的国家名称来建立Series

```
population_sorted = pd.Series(population_dict,country_name_sorted)
```

#照人口数来进行排序

```
population_sorted.sort_values(ascending=False)
```

```
Russia      143910127
Japan       126922333
Germany      82408706
France       65429495
dtype: int64
```

Pandas 资料操作: 用Dictionary字典来建立序列

- 序列的name属性以及index的name属性

```
import numpy as np
import pandas as pd
population_dict = {
    'France':65429495,
    'Germany':82408706,
    'Russia':143910127,
    'Japan':126922333
}
population = pd.Series(population_dict)
#取出国家名称index进行排序
country_name_sorted = np.sort(population.index)
#搭配已经排序好的国家名称来建立Series
population_sorted = pd.Series(population_dict,country_name_sorted)
#照人口数来进行排序
population_sorted.sort_values(ascending=False)
#帮Series加上name属性
population_sorted.name = 'Population'
#帮Series的index加上name属性
population_sorted.index.name = 'Country Name'
```

序列的index的name

Country Name	
France	65429495
Germany	82408706
Japan	126922333
Russia	143910127

Name: Population, dtype: int64

序列的name

Pandas 资料结构: DataFrame

加上其他序列，组合成DataFrame

```
area_dict = {  
    'France':643801,  
    'Germany':357386,  
    'Russia':17125200,  
    'Japan':377972  
}  
area = pd.Series(area_dict)
```

```
countries = pd.DataFrame({'Area':area, 'Population':population_sorted})  
countries
```

France	643801
Germany	357386
Russia	17125200
Japan	377972
dtype: int64	

area

Country Name	
France	65429495
Germany	82408706
Japan	126922333
Russia	143910127
Name: Population, dtype: int64	

population_sorted



	Area	Population
France	643801	65429495
Germany	357386	82408706
Japan	377972	126922333
Russia	17125200	143910127

countries

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Pandas 资料结构: DataFrame

若序列不对等，会形成缺失值

```
iso_code_dict = {  
    'France': 'FR',  
    'Germany': 'DE',  
    'Russia': 'RU',  
}  
iso_code = pd.Series(iso_code_dict)  
  
countries['ISO Code']=iso_code  
countries
```

	Area	Population	ISO Code
France	643801	65429495	FR
Germany	357386	82408706	DE
Japan	377972	126922333	NaN
Russia	17125200	143910127	RU

Pandas 资料操作: 取出部分DataFrame

`countries['Area']`

`countries.iloc[:3,:2]`

`countries.loc[:'Russia',: 'Population']`

	Area	Population	ISO Code
France	643801	65429495	FR
Germany	357386	82408706	DE
Japan	377972	126922333	NaN
Russia	17125200	143910127	RU

countries

France	643801
Germany	357386
Japan	377972
Russia	17125200
Name: Area, dtype: int64	

countries['Area']

	Area	Population
France	643801	65429495
Germany	357386	82408706
Japan	377972	126922333

countries.iloc[:3,:2]

第0,1,2列、第0,1栏

	Area	Population
France	643801	65429495
Germany	357386	82408706
Japan	377972	126922333
Russia	17125200	143910127

countries.loc[:'Russia',: 'Population']

注意：有包含到结束条件

Pandas 资料操作: 依据条件新增字段值

- 如果人口数大于1亿人则为真(True)

```
countries['many_people'] = countries.Population >= 100000000
```

	Area	Population	ISO Code
France	643801	65429495	FR
Germany	357386	82408706	DE
Japan	377972	126922333	NaN
Russia	17125200	143910127	RU



	Area	Population	ISO Code	many_people
France	643801	65429495	FR	False
Germany	357386	82408706	DE	False
Japan	377972	126922333	NaN	True
Russia	17125200	143910127	RU	True

countries

Pandas 资料操作: 删除整栏

- 把整个字段删除

```
del countries['many_people']
```

	Area	Population	ISO Code	many_people
France	643801	65429495	FR	False
Germany	357386	82408706	DE	False
Japan	377972	126922333	NaN	True
Russia	17125200	143910127	RU	True

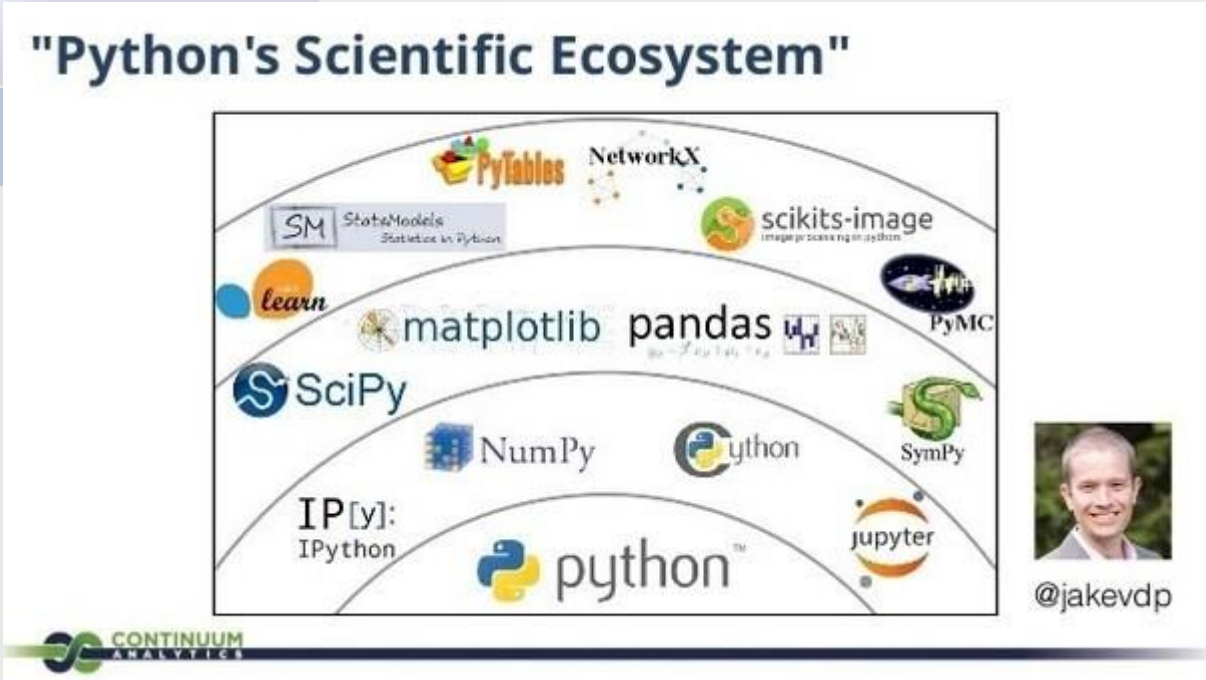


	Area	Population	ISO Code
France	643801	65429495	FR
Germany	357386	82408706	DE
Japan	377972	126922333	NaN
Russia	17125200	143910127	RU

countries

各种函式库综览

函式库	主要特性	用途
NumPy	数值运算	几乎是所有分析的基础
SciPy	科学计算	讯号处理、线性代数、统计
Pandas	表格式分析	资料探索、统计、视觉化
Matplotlib	绘图	资料视觉化
Scikit-learn	机器学习	机器学习算法





Reactor



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