

# Python | Numpy核心语法和代码整理汇总！

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Numpy是一个用python实现的科学计算的扩展程序库，包括：

- 一个强大的N维数组对象Array；
- 比较成熟的（广播）函数库；
- 用于整合C/C++和Fortran代码的工具包；
- 实用的线性代数、傅里叶变换和随机数生成函数。numpy和稀疏矩阵运算包scipy配合使用更加方便。

NumPy (Numeric Python) 提供了许多高级的数值编程工具，如：[矩阵数据类型](#)、[矢量处理](#)，以及[精密的运算库](#)。专为进行严格的数字处理而产生。多为很多大型金融公司使用，以及核心的科学计算组织如：Lawrence Livermore，NASA用其处理一些本来使用C++，Fortran或Matlab等所做的任务。

本文整理了一个[Numpy的小抄表](#)，总结了Numpy的常用操作，可以收藏慢慢看。

(图片可以点开大图查看哦~)

## — 1 — 安装Numpy

可以通过 Pip 或者 Anaconda安装Numpy:

```
$ pip install numpy
```

或

```
$ conda install numpy
```

## 2基础

NumPy最常用的功能之一就是**NumPy数组**：列表和NumPy数组的最主要区别在于功能性和速度。

列表提供基本操作，但NumPy添加了FTTs、卷积、快速搜索、基本统计、线性代数、直方图等。

两者数据科学最重要的区别是**能够用NumPy数组进行元素级计算**。

- **axis 0**：通常指行
- **axis 1**：通常指列

操作	描述	文档
<code>np.array([1, 2, 3])</code>	一维数组	<a href="https://numpy.org/doc/stable/reference/generated/numpy.array.html#numpy.array">https://numpy.org/doc/stable/reference/generated/numpy.array.html#numpy.array</a>
<code>np.array([(1, 2, 3), (4, 5, 6)])</code>	二维数组	<a href="https://numpy.org/doc/stable/reference/generated/numpy.array.html#numpy.array">https://numpy.org/doc/stable/reference/generated/numpy.array.html#numpy.array</a>
<code>np.arange(start, stop, step)</code>	等差数组	<a href="https://docs.scipy.org/doc/numpy/reference/generated/numpy.arange.html">https://docs.scipy.org/doc/numpy/reference/generated/numpy.arange.html</a>

### 1.占位符

操作	描述	文档
<code>np.linspace(0, 2, 9)</code>	数组中添加等差的值	<a href="https://docs.scipy.org/doc/numpy/reference/generated/numpy.linspace.html">https://docs.scipy.org/doc/numpy/reference/generated/numpy.linspace.html</a>
<code>np.zeros((1, 2))</code>	创建全0数组	<a href="https://docs.scipy.org/doc/numpy/reference/generated/numpy.zeros.html">docs.scipy.org/doc/numpy/reference/generated/numpy.zeros.html</a>
<code>np.ones((1, 2))</code>	创建全1数组	<a href="https://docs.scipy.org/doc/numpy/reference/generated/numpy.ones.html#numpy.ones">https://docs.scipy.org/doc/numpy/reference/generated/numpy.ones.html#numpy.ones</a>
<code>np.random.random((5, 5))</code>	创建随机数的数组	<a href="https://docs.scipy.org/doc/numpy/reference/generated/numpy.random.random.html">https://docs.scipy.org/doc/numpy/reference/generated/numpy.random.random.html</a>
<code>np.empty((2, 2))</code>	创建空数组	<a href="https://numpy.org/doc/stable/reference/generated/numpy.empty.html">https://numpy.org/doc/stable/reference/generated/numpy.empty.html</a>

举例：

```
import numpy as np

# 1 dimensional
x = np.array([1,2,3])
# 2 dimensional
y = np.array([(1,2,3), (4,5,6)])

x = np.arange(3)
>>> array([0, 1, 2])

y = np.arange(3.0)
>>> array([ 0., 1., 2.])

x = np.arange(3,7)
```

```
>>> array([3, 4, 5, 6])

y = np.arange(3,7,2)
>>> array([3, 5])
```

2.数组属性

语法	描述	文档
array.shape	维度 (行, 列)	<a href="https://docs.scipy.org/doc/numpy/reference/generated/numpy.ndarray.shape.html">https://docs.scipy.org/doc/numpy/reference/generated/numpy.ndarray.shape.html</a>
len(array)	数组 长度	<a href="https://docs.python.org/3.5/library/functions.html#len">https://docs.python.org/3.5/library/functions.html#len</a>
array.ndim	数组 的维 度数	<a href="https://docs.scipy.org/doc/numpy/reference/generated/numpy.ndarray.ndim.html">https://docs.scipy.org/doc/numpy/reference/generated/numpy.ndarray.ndim.html</a>
array.size	数组 的元 素数	<a href="https://docs.scipy.org/doc/numpy/reference/generated/numpy.ndarray.size.html">https://docs.scipy.org/doc/numpy/reference/generated/numpy.ndarray.size.html</a>
array.dtype	数据 类型	<a href="https://docs.scipy.org/doc/numpy/reference/arrays.dtypes.html">https://docs.scipy.org/doc/numpy/reference/arrays.dtypes.html</a>
array.astype(type)	转换 数组 类型	<a href="https://docs.scipy.org/doc/numpy/reference/generated/numpy.ndarray.astype.html">https://docs.scipy.org/doc/numpy/reference/generated/numpy.ndarray.astype.html</a>
type(array)	显示 数组 类型	<a href="https://numpy.org/doc/stable/user/basics.types.html">https://numpy.org/doc/stable/user/basics.types.html</a>

3.拷贝 /排序

操作	描述	文档
<code>np.copy(array)</code>	创建数组拷贝	<a href="https://docs.scipy.org/doc/numpy/reference/generated/numpy.copy.html">https://docs.scipy.org/doc/numpy/reference/generated/numpy.copy.html</a>
<code>other = array.copy()</code>	创建数组深拷贝	<a href="https://docs.scipy.org/doc/numpy/reference/generated/numpy.copy.html">https://docs.scipy.org/doc/numpy/reference/generated/numpy.copy.html</a>
<code>array.sort()</code>	排序一个数组	<a href="https://docs.scipy.org/doc/numpy/reference/generated/numpy.sort.html">https://docs.scipy.org/doc/numpy/reference/generated/numpy.sort.html</a>
<code>array.sort(axis=0)</code>	按照指定轴排序一个数组	<a href="https://docs.scipy.org/doc/numpy/reference/generated/numpy.sort.html">https://docs.scipy.org/doc/numpy/reference/generated/numpy.sort.html</a>

举例：

```
import numpy as np
# Sort sorts in ascending order
y = np.array([10, 9, 8, 7, 6, 5, 4, 3, 2, 1])
y.sort()
print(y)
>>> [ 1  2  3  4  5  6  7  8  9 10]
```

4.数组操作例程

增加或减少元素

操作	描述	文档
<code>np.append(a,b)</code>	增加数据项到数组	<a href="https://docs.scipy.org/doc/numpy/reference/generated/numpy.append.html">https://docs.scipy.org/doc/numpy/reference/generated/numpy.append.html</a>
<code>np.insert(array, 1, 2, axis)</code>	沿着数组0轴或者1轴插入数据项	<a href="https://docs.scipy.org/doc/numpy/reference/generated/numpy.insert.html">https://docs.scipy.org/doc/numpy/reference/generated/numpy.insert.html</a>
<code>np.resize((2,4))</code>	将数组调整为形状(2,4)	<a href="https://docs.scipy.org/doc/numpy/reference/generated/numpy.resize.html">https://docs.scipy.org/doc/numpy/reference/generated/numpy.resize.html</a>
<code>np.delete(array,1,axis)</code>	从数组里删除数据项	<a href="https://numpy.org/doc/stable/reference/generated/numpy.delete.html">https://numpy.org/doc/stable/reference/generated/numpy.delete.html</a>

举例：

```
import numpy as np
# Append items to array
a = np.array([(1, 2, 3),(4, 5, 6)])
b = np.append(a, [(7, 8, 9)])
print(b)
>>> [1 2 3 4 5 6 7 8 9]

# Remove index 2 from previous array
print(np.delete(b, 2))
>>> [1 2 4 5 6 7 8 9]
```

组合数组

操作	描述	文档
<code>np.concatenate((a,b), axis=0)</code>	连接2个数组，添加到末尾	<a href="https://docs.scipy.org/doc/numpy/reference/generated/numpy.concatenate.html">https://docs.scipy.org/doc/numpy/reference/generated/numpy.concatenate.html</a>
<code>np.vstack((a,b))</code>	按照行堆叠数组	<a href="https://numpy.org/doc/stable/reference/generated/numpy.vstack.html">https://numpy.org/doc/stable/reference/generated/numpy.vstack.html</a>
<code>np.hstack((a,b))</code>	按照列堆叠数组	<a href="https://docs.scipy.org/doc/numpy/reference/generated/numpy.hstack.html#numpy.hstack">docs.scipy.org/doc/numpy/reference/generated/numpy.hstack.html#numpy.hstack</a>

举例：

```
import numpy as np
a = np.array([1, 3, 5])
b = np.array([2, 4, 6])

# Stack two arrays row-wise
print(np.vstack((a,b)))
>>> [[1 3 5]
      [2 4 6]]

# Stack two arrays column-wise
print(np.hstack((a,b)))
>>> [1 3 5 2 4 6]
```

分割数组

操作	描述	文档
<code>numpy.split()</code>	分割数组	<a href="https://docs.scipy.org/doc/numpy/reference/generated/numpy.split.html">https://docs.scipy.org/doc/numpy/reference/generated/numpy.split.html</a>
<code>np.array_split(array, 3)</code>	将数组拆分为大小（几乎）相同的子数组	<a href="https://docs.scipy.org/doc/numpy/reference/generated/numpy.array_split.html#numpy.array_split">https://docs.scipy.org/doc/numpy/reference/generated/numpy.array_split.html#numpy.array_split</a>
<code>numpy.hsplit(array, 3)</code>	在第3个索引处水平拆分数组	<a href="https://numpy.org/doc/stable/reference/generated/numpy.hsplit.html#numpy.hsplit">https://numpy.org/doc/stable/reference/generated/numpy.hsplit.html#numpy.hsplit</a>

举例：

```
# Split array into groups of ~3
a = np.array([1, 2, 3, 4, 5, 6, 7, 8])
print(np.array_split(a, 3))
>>> [array([1, 2, 3]), array([4, 5, 6]), array([7, 8])]
```

数组形状变化

- 操作

操作	描述	文档
<code>other = ndarray.flatten()</code>	平铺一个二维数组到一维数组	<a href="https://numpy.org/doc/stable/reference/generated/numpy.ndarray.flatten.html">https://numpy.org/doc/stable/reference/generated/numpy.ndarray.flatten.html</a>
<code>numpy.flip()</code>	翻转一维数组中元素的顺序	<a href="https://docs.scipy.org/doc/stable/reference/generated/numpy.flip.html">https://docs.scipy.org/doc/stable/reference/generated/numpy.flip.html</a>
<code>np.ndarray[::-1]</code>	翻转一维数组中元素的顺序	
<code>reshape</code>	改变数组的维数	<a href="https://docs.scipy.org/doc/stable/reference/generated/numpy.reshape.html">https://docs.scipy.org/doc/stable/reference/generated/numpy.reshape.html</a>
<code>squeeze</code>	从数组的形状中删除单维度条目	<a href="https://numpy.org/doc/stable/reference/generated/numpy.squeeze.html">https://numpy.org/doc/stable/reference/generated/numpy.squeeze.html</a>
<code>expand_dims</code>	扩展数组维度	<a href="https://docs.scipy.org/doc/numpy-1.13.0/reference/generated/numpy.expand_dims.html">https://docs.scipy.org/doc/numpy-1.13.0/reference/generated/numpy.expand_dims.html</a>

• 其他

操作	描述	文档
<code>other = ndarray.flatten()</code>	平铺 2维 数组 到1 维数 组	<a href="https://numpy.org/doc/stable/reference/generated/numpy.ndarray.flatten.html">https://numpy.org/doc/stable/reference/generated/numpy.ndarray.flatten.html</a>
<code>array = np.transpose(other)</code> <code>array.T</code>	数组 转置	<a href="https://numpy.org/doc/stable/reference/generated/numpy.transpose.html">https://numpy.org/doc/stable/reference/generated/numpy.transpose.html</a>
<code>inverse = np.linalg.inv(matrix)</code>	求矩 阵的 逆矩 阵	<a href="https://docs.scipy.org/doc/numpy/reference/generated/numpy.linalg.inv.html">https://docs.scipy.org/doc/numpy/reference/generated/numpy.linalg.inv.html</a>

举例：

```
# Find inverse of a given matrix
>>> np.linalg.inv([[3,1],[2,4]])
array([[ 0.4, -0.1],
       [-0.2, 0.3]])
```

5.数学计算

操作

操作	描述	文档
<code>np.add(x,y)x + y</code>	加	<a href="https://docs.scipy.org/doc/numpy/reference/generated/numpy.add.html">https://docs.scipy.org/doc/numpy/reference/generated/numpy.add.html</a>
<code>np.subtract(x,y)x - y</code>	减	<a href="https://docs.scipy.org/doc/numpy/reference/generated/numpy.subtract.html#numpy.subtract">https://docs.scipy.org/doc/numpy/reference/generated/numpy.subtract.html#numpy.subtract</a>
<code>np.divide(x,y)x / y</code>	除	<a href="https://docs.scipy.org/doc/numpy/reference/generated/numpy.divide.html#numpy.divide">https://docs.scipy.org/doc/numpy/reference/generated/numpy.divide.html#numpy.divide</a>
<code>np.multiply(x,y)x * y</code>	乘	<a href="https://docs.scipy.org/doc/numpy/reference/generated/numpy.multiply.html#numpy.multiply">https://docs.scipy.org/doc/numpy/reference/generated/numpy.multiply.html#numpy.multiply</a>
<code>np.sqrt(x)</code>	平方根	<a href="https://docs.scipy.org/doc/numpy/reference/generated/numpy.sqrt.html#numpy.sqrt">https://docs.scipy.org/doc/numpy/reference/generated/numpy.sqrt.html#numpy.sqrt</a>
<code>np.sin(x)</code>	元素正弦	<a href="https://docs.scipy.org/doc/numpy/reference/generated/numpy.sin.html#numpy.sin">https://docs.scipy.org/doc/numpy/reference/generated/numpy.sin.html#numpy.sin</a>
<code>np.cos(x)</code>	元素余弦	<a href="https://docs.scipy.org/doc/numpy/reference/generated/numpy.cos.html#numpy.cos">https://docs.scipy.org/doc/numpy/reference/generated/numpy.cos.html#numpy.cos</a>
<code>np.log(x)</code>	元素自然对数	<a href="https://docs.scipy.org/doc/numpy/reference/generated/numpy.log.html#numpy.log">https://docs.scipy.org/doc/numpy/reference/generated/numpy.log.html#numpy.log</a>
<code>np.dot(x,y)</code>	点积	<a href="https://docs.scipy.org/doc/numpy/reference/generated/numpy.dot.html">https://docs.scipy.org/doc/numpy/reference/generated/numpy.dot.html</a>
<code>np.roots([1,0,-4])</code>	给定多项式系数的根	<a href="https://docs.scipy.org/doc/numpy/reference/generated/numpy.roots.html">https://docs.scipy.org/doc/numpy/reference/generated/numpy.roots.html</a>

举例:

```
# If a 1d array is added to a 2d array (or the other way), NumPy
# chooses the array with smaller dimension and adds it to the one
# with bigger dimension
a = np.array([1, 2, 3])
```



```
b = np.array([(1, 2, 3), (4, 5, 6)])
print(np.add(a, b))
>>> [[2 4 6]
      [5 7 9]]

# Example of np.roots
# Consider a polynomial function (x-1)^2 = x^2 - 2*x + 1
# Whose roots are 1,1
>>> np.roots([1,-2,1])
array([1., 1.])
# Similarly x^2 - 4 = 0 has roots as x=±2
>>> np.roots([1,0,-4])
array([-2., 2.] )
```

比较

操作	描述	文档
==	等于	<a href="https://docs.python.org/2/library/stdtypes.html">https://docs.python.org/2/library/stdtypes.html</a>
!=	不等于	<a href="https://docs.python.org/2/library/stdtypes.html">https://docs.python.org/2/library/stdtypes.html</a>
<	小于	<a href="https://docs.python.org/2/library/stdtypes.html">https://docs.python.org/2/library/stdtypes.html</a>
>	大于	<a href="https://docs.python.org/2/library/stdtypes.html">https://docs.python.org/2/library/stdtypes.html</a>
<=	小于等于	<a href="https://docs.python.org/2/library/stdtypes.html">https://docs.python.org/2/library/stdtypes.html</a>
>=	大于等于	<a href="https://docs.python.org/2/library/stdtypes.html">https://docs.python.org/2/library/stdtypes.html</a>
np.array_equal(x,y)	数组比较	<a href="https://numpy.org/doc/stable/reference/generated/numpy.array_equal.html">https://numpy.org/doc/stable/reference/generated/numpy.array_equal.html</a>

举例：

```
# Using comparison operators will create boolean NumPy arrays
z = np.array([1, 2, 3, 4, 5, 6, 7, 8, 9, 10])
c = z < 6
print(c)
>>> [ True  True  True  True  True False False False False False]
```

基本的统计

操作	描述	文档
np.mean(array)	Mean	<a href="https://numpy.org/doc/stable/reference/generated/numpy.mean.html#numpy.mean">https://numpy.org/doc/stable/reference/generated/numpy.mean.html#numpy.mean</a>
np.median(array)	Median	<a href="https://numpy.org/doc/stable/reference/generated/numpy.median.html#numpy.median">https://numpy.org/doc/stable/reference/generated/numpy.median.html#numpy.median</a>
array.corrcoef()	Correlation Coefficient	<a href="https://numpy.org/doc/stable/reference/generated/numpy.corrcoef.html#numpy.corrcoef">https://numpy.org/doc/stable/reference/generated/numpy.corrcoef.html#numpy.corrcoef</a>
np.std(array)	Standard Deviation	<a href="https://docs.scipy.org/doc/numpy/reference/generated/numpy.std.html#numpy.std">https://docs.scipy.org/doc/numpy/reference/generated/numpy.std.html#numpy.std</a>

举例：

```
# Statistics of an array
a = np.array([1, 1, 2, 5, 8, 10, 11, 12])

# Standard deviation
print(np.std(a))
>>> 4.2938910093294167

# Median
print(np.median(a))
>>> 6.5
```

更多

操作	描述	文档
array.sum()	数组求和	<a href="https://numpy.org/doc/stable/reference/generated/numpy.sum.html">https://numpy.org/doc/stable/reference/generated/numpy.sum.html</a>
array.min()	数组求最小值	<a href="https://numpy.org/doc/stable/reference/generated/numpy.ndarray.min.html">https://numpy.org/doc/stable/reference/generated/numpy.ndarray.min.html</a>
array.max(axis=0)	数组求最大值 (沿着0轴)	
array.cumsum(axis=0)	指定轴求累计和	<a href="https://numpy.org/doc/stable/reference/generated/numpy.cumsum.html">https://numpy.org/doc/stable/reference/generated/numpy.cumsum.html</a>

6.切片和子集

操作	描述	文档
array[i]	索引 <i>i</i> 处的一维数组	<a href="https://numpy.org/doc/stable/reference/arrays.indexing.html">https://numpy.org/doc/stable/reference/arrays.indexing.html</a>
array[i,j]	索引在[i][j]处的二维数组	<a href="https://numpy.org/doc/stable/reference/arrays.indexing.html">https://numpy.org/doc/stable/reference/arrays.indexing.html</a>
array[i<4]	布尔索引	<a href="https://numpy.org/doc/stable/reference/arrays.indexing.html">https://numpy.org/doc/stable/reference/arrays.indexing.html</a>
array[0:3]	选择索引为 0, 1和 2	<a href="https://numpy.org/doc/stable/reference/arrays.indexing.html">https://numpy.org/doc/stable/reference/arrays.indexing.html</a>
array[0:2,1]	选择第0,1行, 第1列	<a href="https://numpy.org/doc/stable/reference/arrays.indexing.html">https://numpy.org/doc/stable/reference/arrays.indexing.html</a>
array[:1]	选择第0行数据项 (与[0:1, :]相同)	<a href="https://numpy.org/doc/stable/reference/arrays.indexing.html">https://numpy.org/doc/stable/reference/arrays.indexing.html</a>
array[1:2, :]	选择第1行	<a href="https://numpy.org/doc/stable/reference/arrays.indexing.html">https://numpy.org/doc/stable/reference/arrays.indexing.html</a>
[comment]: <> "	array[1,...]	等同于 array[1,:,:]
array[::-1]	反转数组	同上

举例:

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

# The index before the comma refers to rows,
# the index after the comma refers to columns
print(b[0:1, 2])
>>> [3]

print(b[:len(b), 2])
>>> [3 6]

print(b[0, :])
>>> [1 2 3]

print(b[0, 2:])
>>> [3]

print(b[:, 0])
>>> [1 4]

c = np.array([(1, 2, 3), (4, 5, 6)])
d = c[1:2, 0:2]
```

```
print(d)
>>> [[4 5]]
```

### 切片举例:

```
import numpy as np
a1 = np.arange(0, 6)
a2 = np.arange(10, 16)
a3 = np.arange(20, 26)
a4 = np.arange(30, 36)
a5 = np.arange(40, 46)
a6 = np.arange(50, 56)
a = np.vstack((a1, a2, a3, a4, a5, a6))
```

### 生成矩阵和切片图示

```
>>> a[0,3:5]
array([3,4])
>>> a[4:,4:]
array([[44,45],[54,55]])
>>> a[:,2]
array([2,12,22,32,42,52])
>>> a[2::2,::2]
array([[20,22,24],
       [40,42,44]])
```

0	1	2	3	4	5
10	11	12	13	14	15
20	21	22	23	24	25
30	31	32	33	34	35
40	41	42	43	44	45
50	51	52	53	54	55

```
>>> a[(0,1,2,3,4),(1,2,3,4,5)]
array([1,12,23,34,45])
>>> a[3:,[0,2,5]]
array([[30,32,35],
       [40,42,45],
       [50,52,55]])
>>> mask=np.array([1,0,1,0,0,1],
                   dtype=np.bool)
>>> a[mask,2]
array([2,22,52])
```

0	1	2	3	4	5
10	11	12	13	14	15
20	21	22	23	24	25
30	31	32	33	34	35
40	41	42	43	44	45
50	51	52	53	54	55

第 0 轴

第 1 轴

## 7.小技巧

### 布尔索引

```
# Index trick when working with two np-arrays
a = np.array([1,2,3,6,1,4,1])
b = np.array([5,6,7,8,3,1,2])

# Only saves a at index where b == 1
other_a = a[b == 1]
#Saves every spot in a except at index where b != 1
other_other_a = a[b != 1]

import numpy as np
x = np.array([4,6,8,1,2,6,9])
y = x > 5
print(x[y])
>>> [6 8 6 9]

# Even shorter
x = np.array([1, 2, 3, 4, 4, 35, 212, 5, 5, 6])
print(x[x < 5])
>>> [1 2 3 4 4]
```

#### 参考:

<https://github.com/juliangaal/python-cheat-sheet>

----- **END** -----

我是**王博Kings**，985AI博士，华为云专家、CSDN博客专家（人工智能领域优质作者）。单个AI开源项目现在已经获得了2100+标星。现在在做AI相关内容，欢迎一起交流学习、生活各方面的问题，一起加油进步！

我们微信交流群涵盖以下方向（但并不局限于以下内容）：人工智能，计算机视觉，自然语言处理，目标检测，语义分割，自动驾驶，GAN，强化学习，SLAM，人脸检测，最新算法，最新论文，OpenCV，TensorFlow，PyTorch，开源框架，学习方法...

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