

Lesson 06: numpy 1 ~ 2

2023-01-30

ref

[https://guebin.github.io/IP2022/2022/04/06/\(6\)-46.html](https://guebin.github.io/IP2022/2022/04/06/(6)-46.html)

import

```
import numpy as np
```

1

```
a=np.array([1,2,3]) # list ndarray  
l=[1,2,3]
```

```
a+1 ## [1,2,3] + 1 = [2,3,4]
```

```
array([2, 3, 4])
```

```
l+1
```

TypeError: can only concatenate list (not "int") to list

```
a*2
```

```
array([2, 4, 6])
```

```
l*2
```

```
[1, 2, 3, 1, 2, 3]
```

```
a/2
```

```
array([0.5, 1. , 1.5])
```

```
l/2
```

TypeError: unsupported operand type(s) for /: 'list' and 'int'

```
a**2
```

```
array([1, 4, 9])
```

```
l**2
```

TypeError: unsupported operand type(s) for ** or pow(): 'list' and 'int'

```
a%2 # %2 = 2          a=[1,2,3]
```

```
array([1, 0, 1])
```

```
l%2
```

TypeError: unsupported operand type(s) for %: 'list' and 'int'

```
np.sqrt(a), np.sqrt(l)
```

```
(array([1.          , 1.41421356, 1.73205081]),  
 array([1.          , 1.41421356, 1.73205081]))
```

```
np.log(a), np.log(l)
```

```
(array([0.          , 0.69314718, 1.09861229]),  
 array([0.          , 0.69314718, 1.09861229]))
```

```
np.exp(a), np.exp(l)
```

```
(array([ 2.71828183,  7.3890561 , 20.08553692]),  
 array([ 2.71828183,  7.3890561 , 20.08553692]))
```

```
np.sin(a), np.sin(l)
```

```
(array([0.84147098, 0.90929743, 0.14112001]),  
 array([0.84147098, 0.90929743, 0.14112001]))
```

2

1

-

```
l=[11,22,33,44,55,66]
a=np.array(l)
```

-

```
l[0],l[1],l[2],l[3],l[-2],l[-1]
```

(11, 22, 33, 44, 55, 66)

```
a[0],a[1],a[2],a[3],a[-2],a[-1]
```

(11, 22, 33, 44, 55, 66)

- : ()

```
l[2:4] # index 2 , index 4
```

[33, 44]

```
a[2:4]
```

array([33, 44])

-

```
a
```

array([11, 22, 33, 44, 55, 66])

```
a[[0,2,4]] # index=0, index=2, index=4
```

```
array([11, 33, 55])
```

```
l[[0,2,4]] #
```

TypeError: list indices must be integers or slices, not list

-

```
a
```

```
array([11, 22, 33, 44, 55, 66])
```

```
a[[True,False,True,False,True,False]]
```

```
array([11, 33, 55])
```

?

```
a < 33
```

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

```
a[a<33]
```

```
array([11, 22])
```

```
l<33 #
```

TypeError: '<' not supported between instances of 'list' and 'int'

```
1[[True,False,True,False,True,False]] #
```

TypeError: list indices must be integers or slices, not list

2

```
- 2 np.array
```

```
A = [[1,2,3,4],[-1,-2,-3,-4],[5,6,7,8],[-5,-6,-7,-8]]  
A2 = np.array(A)
```

```
A2
```

```
array([[ 1,  2,  3,  4],  
       [-1, -2, -3, -4],  
       [ 5,  6,  7,  8],  
       [-5, -6, -7, -8]])
```

```
A
```

```
[[1, 2, 3, 4], [-1, -2, -3, -4], [5, 6, 7, 8], [-5, -6, -7, -8]]
```

```
- A
```

```
A[0][0] # (1,1)
```

```
1
```

```
A[1][2] # (2,3)
```

```
-3
```

```
A[-1][0] # (4,1)
```

-5

- A2

```
A2[0][0] # (1,1)
```

1

```
A2[1][2] # (2,3)
```

-3

```
A2[-1][0] # (4,1)
```

-5

- A2 (, R , list)

```
A2[0,0] # (1,1)
```

1

```
A2[1,2] # (2,3)
```

-3

```
A2[-1,0] # (4,1)
```

-5

- & !

```
A2
```

```
array([[ 1,  2,  3,  4],  
       [-1, -2, -3, -4],  
       [ 5,  6,  7,  8],  
       [-5, -6, -7, -8]])
```

```
A2[0,0:2] # 1 1 , 1 2
```

```
array([1, 2])
```

```
A2[0,:] # 1
```

```
array([1, 2, 3, 4])
```

```
A2[0] # 1
```

```
array([1, 2, 3, 4])
```

```
A2[[0,2],:] # 1 , 3
```

```
array([[1, 2, 3, 4],  
       [5, 6, 7, 8]])
```

```
A2[[0,2]] # 1 , 3
```

```
array([[1, 2, 3, 4],  
       [5, 6, 7, 8]])
```



```
A2[:,0] # 1
```

```
array([ 1, -1,  5, -5])
```

```
A2[:,[0]] # 1
```

```
array([[ 1],  
       [-1],  
       [ 5],  
       [-5]])
```

```
A2[:,[0,2]] # 1 , 3
```

```
array([[ 1,  3],  
       [-1, -3],  
       [ 5,  7],  
       [-5, -7]])
```

```
A2[0:2,[0,2]] # 1 ~2 // 1,3
```

```
array([[ 1,  3],  
       [-1, -3]])
```

1

-

```
np.array((1,2,3)) # ->
```

```
array([1, 2, 3])
```

```
np.array([1,2,3]) # ->
```

```
array([1, 2, 3])
```

- range()

```
np.array(range(10)) # range(10) ->
```

```
array([0, 1, 2, 3, 4, 5, 6, 7, 8, 9])
```

- np.zeros, np.ones

```
np.zeros(3)
```

```
array([0., 0., 0.])
```

```
np.ones(4)
```

```
array([1., 1., 1., 1.])
```

- np.linspace

```
np.linspace(0,1,12) # 0 1 ( )
```

```
array([0.          , 0.09090909, 0.18181818, 0.27272727, 0.36363636,  
       0.45454545, 0.54545455, 0.63636364, 0.72727273, 0.81818182,  
       0.90909091, 1.          ])
```

```
len(np.linspace(0,1,12)) # 12
```

```
12
```

- np.arange

```
np.arange(5) # np.array(range(5))
```

```
array([0, 1, 2, 3, 4])
```

```
np.arange(1,6) # np.array(range(1,6))
```

```
array([1, 2, 3, 4, 5])
```

reshape

- reshape: ndarray

```
a=np.array([11,22,33,44,55,66])  
a ##      6
```

```
array([11, 22, 33, 44, 55, 66])
```

```
a.reshape(2,3) ## (2,3) matrix
```

```
array([[11, 22, 33],  
       [44, 55, 66]])
```

note: reshape a

```
a # a
```

```
array([11, 22, 33, 44, 55, 66])
```

```
b= a.reshape(2,3) # a reshape    b  
b
```

```
array([[11, 22, 33],  
       [44, 55, 66]])
```

```
a # a
```

```
array([11, 22, 33, 44, 55, 66])
```

```
- b a
```

```
b
```

```
array([[11, 22, 33],  
       [44, 55, 66]])
```

```
b.reshape(6) # b (2,3) matrix , 6 .
```

```
array([11, 22, 33, 44, 55, 66])
```

```
- reshape with -1
```

```
a=np.arange(24) # np.array(range(24))  
a
```

```
array([ 0,  1,  2,  3,  4,  5,  6,  7,  8,  9, 10, 11, 12, 13, 14, 15, 16,  
       17, 18, 19, 20, 21, 22, 23])
```

```
a.reshape(2,-1)
```

```
array([[ 0,  1,  2,  3,  4,  5,  6,  7,  8,  9, 10, 11],  
       [12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23]])
```

```
a.reshape(3,-1)
```

```
array([[ 0,  1,  2,  3,  4,  5,  6,  7],  
       [ 8,  9, 10, 11, 12, 13, 14, 15],  
       [16, 17, 18, 19, 20, 21, 22, 23]])
```

```
a.reshape(4,-1)
```

```
array([[ 0,  1,  2,  3,  4,  5],  
       [ 6,  7,  8,  9, 10, 11],  
       [12, 13, 14, 15, 16, 17],  
       [18, 19, 20, 21, 22, 23]])
```

```
a.reshape(5,-1)
```

ValueError: cannot reshape array of size 24 into shape (5,newaxis)

```
a.reshape(6,-1)
```

```
array([[ 0,  1,  2,  3],  
       [ 4,  5,  6,  7],  
       [ 8,  9, 10, 11],  
       [12, 13, 14, 15],  
       [16, 17, 18, 19],  
       [20, 21, 22, 23]])
```

```
a.reshape(7,-1)
```

ValueError: cannot reshape array of size 24 into shape (7,newaxis)

```
a.reshape(8,-1)
```

```
array([[ 0,  1,  2],  
       [ 3,  4,  5],  
       [ 6,  7,  8],  
       [ 9, 10, 11],  
       [12, 13, 14],  
       [15, 16, 17],  
       [18, 19, 20],  
       [21, 22, 23]])
```

```
a.reshape(12,-1)
```

```
array([[ 0,  1],
       [ 2,  3],
       [ 4,  5],
       [ 6,  7],
       [ 8,  9],
       [10, 11],
       [12, 13],
       [14, 15],
       [16, 17],
       [18, 19],
       [20, 21],
       [22, 23]])
```

```
b= a.reshape(12,-1)
b
```

```
array([[ 0,  1],
       [ 2,  3],
       [ 4,  5],
       [ 6,  7],
       [ 8,  9],
       [10, 11],
       [12, 13],
       [14, 15],
       [16, 17],
       [18, 19],
       [20, 21],
       [22, 23]])
```

```
b.reshape(-1) # b      24    !
```

```
array([ 0,  1,  2,  3,  4,  5,  6,  7,  8,  9, 10, 11, 12, 13, 14, 15, 16,
       17, 18, 19, 20, 21, 22, 23])
```

2

```
np.zeros((3,3))
```

```
array([[0., 0., 0.],  
       [0., 0., 0.],  
       [0., 0., 0.]])
```

```
np.ones((3,3))
```

```
array([[1., 1., 1.],  
       [1., 1., 1.],  
       [1., 1., 1.]])
```

```
np.eye(3)
```

```
array([[1., 0., 0.],  
       [0., 1., 0.],  
       [0., 0., 1.]])
```

```
np.diag([1,2,3,-1])
```

```
array([[ 1,  0,  0,  0],  
       [ 0,  2,  0,  0],  
       [ 0,  0,  3,  0],  
       [ 0,  0,  0, -1]])
```

```
np.random.randn(10) # 10
```

```
array([ 0.27184979, -0.4540305 ,  0.24538219, -3.11389327,  1.06478234,  
       0.12051154,  0.01503231, -0.06744028,  2.30710253,  0.78840453])
```

```
np.random.rand(10) # 0~1 10
```

```
array([0.67729671, 0.19584606, 0.4564896 , 0.9308976 , 0.49080792,  
       0.03410752, 0.47480477, 0.44519947, 0.20608611, 0.85576604])
```

```
np.random.randn(4).reshape(2,2) # 4 (2,2) ndarray
```

```
array([[-0.97378852,  0.5250826 ],  
       [-0.97400213, -0.59600022]])
```

```
np.random.rand(4).reshape(2,2) # 0~1 4 (2,2) ndarray
```

```
array([[0.03708309, 0.56122376],  
       [0.80934488, 0.65723348]])
```

```
A=np.arange(4).reshape(2,2)  
A
```

```
array([[0, 1],  
       [2, 3]])
```

```
A.T # .T
```

```
array([[0, 2],  
       [1, 3]])
```

```
np.linalg.inv(A) # np.linalg.inv
```

```
array([[-1.5,  0.5],  
       [ 1. ,  0. ]])
```



```
A @ np.linalg.inv(A) # @
```

```
array([[1., 0.],  
       [0., 1.]])
```

Quiz

```
A=np.array(range(6))  
A # 6
```

```
array([0, 1, 2, 3, 4, 5])
```

```
6 A (2,3) ndarray (reshape )
```