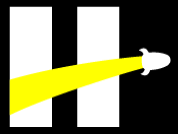
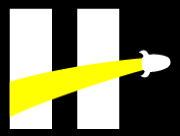
Numpy



Numpy

NumPy (Numerical Python) es una librería numérica de Python, base de todos los cálculos científicos y muchas de las librerías de Machine Learning, como Scikit-Learn, que con sus modelos, cuando retorna un resultado, en general lo retorna en un formato Numpy.

De código abierto, que proporciona estructuras de datos matriciales y funciones matemáticas de alto nivel.



Arrays de Numpy

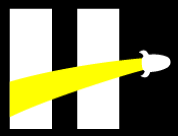
En NumPy se trabaja con una estructura de datos llamada array o arreglos numéricos multidimensionales.

* Parecidos a las listas de Python, heredan algunas propiedades como el ser mutables y poder realizar slicing.

* Pero tienen diferencias importantes: son menos pesados, más rápidos y permiten crear fácilmente arrays de N dimensiones.

Arrays de Numpy

* Un array unidimensional puede ser una fila o una columna de una tabla, igual que una lista, esta se conoce como vector.
* Un array bidimensional es lo que llamamos comúnmente matriz.
* Un array de 3 dimensiones o más, es decir, una matriz de matrices, se conoce como tensor.



Crear Arrays

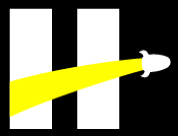
A partir de una lista:

```
>>> my_list = [0, 1, 2, 3, 4]
>>> print(np.array(my_list))
[0 1 2 3 4]
```

A partir de secuencias:

```
>>> print(np.arange(start=2, stop=10, step=2))
[2 4 6 8]
```

```
>>> print(np.linspace(0, 1, 11))
[0.  0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1. ]
```



Crear Arrays

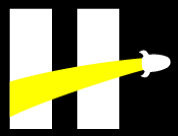
Predefinidos:

```
>>> print(np.zeros(4))
[0. 0. 0. 0.]
```

```
>>> print(np.ones(6))
[1. 1. 1. 1. 1. 1.]
```

```
>>> print(np.full(shape=(2, 2), fill_value=5))
[[5 5]
 [5 5]]
```

```
>>> base = np.linspace(2, 6, 4)
>>> print(np.full_like(base, np.pi))
[3.14159265 3.14159265 3.14159265 3.14159265]
```



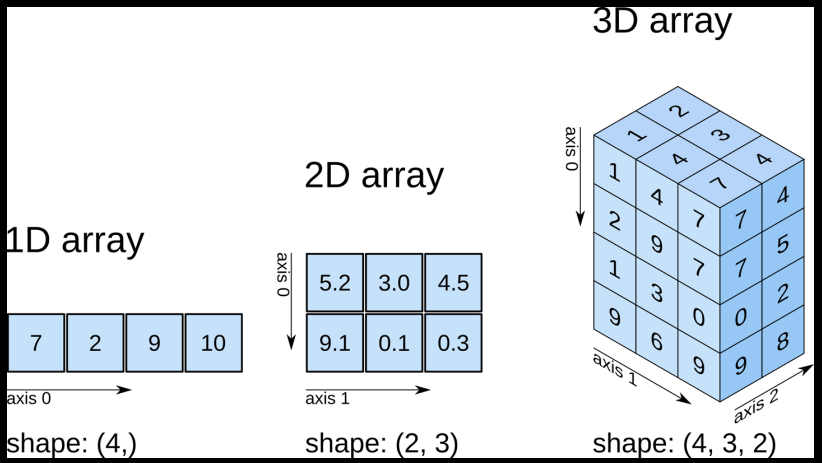
Crear Arrays

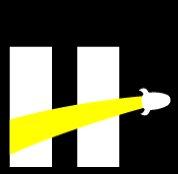
Aleatorios:

```
>>> print(np.random.rand(2, 2))
[[0.62740202 0.11171536]
 [0.47526728 0.19739417]]
>>>
>>> print(np.random.uniform(low=0, high=1, size=6))
[0.7878737  0.3431897  0.77765595 0.60943181 0.30961326 0.60167083]
 >>>
>>> print(np.random.randn(2, 2))
[[ 0.91140011  1.72792052]
 [-0.84028707 -0.27378577]]
>>>
>>> print(np.random.normal(loc=0, scale=2, size=6))
[-2.36743682 -3.12673482 -1.14254395 -3.19805542 -1.11930443 -2.70161226]
```

Tamaño de Arrays

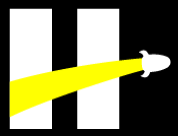
```
>>> a = np.arange(1,10)
>>> print(a)
[1 2 3 4 5 6 7 8 9]
>>> B = np.reshape(a, [3,3])
>>> print(B)
[[1 2 3]
 [4 5 6]
 [7 8 9]]
>>> print(B.dtype)
int64
```





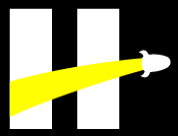
Slicing con Arrays

```
>>> matrix_cool = np.arange(9).reshape(3, 3)
>>> print(matrix_cool)
[[0 1 2]
 [3 4 5]
 [6 7 8]]
>>> print(matrix_cool[1, 2])
5
>>> print(matrix_cool[0, :])
[0 1 2]
>>> print(matrix_cool[:, 1])
[1 4 7]
>>> print(matrix_cool[:, 1:])
[[1 2]
 [4 5]
 [7 8]]
>>> print(matrix_cool[0:2, 0:2])
[[0 1]
 [3 4]]
```



Copiar Arrays

```
>>> a1 = np.array([2, 4, 6])
>>> a2 = a1.copy()
>>> a1[0] = 8
>>> print(a1)
>>> print(a2)
[8 4 6]
[2 4 6]
```

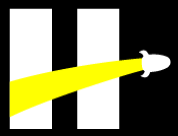


Operaciones con Arrays

```
>>> A = np.arange(5, 11)
>>> print(A)
[ 5  6  7  8  9 10]
>>> print(A + 10)
[15 16 17 18 19 20]
```

Suma y Resta

```
>>> B = np.full(4, 3)
>>> C = np.ones(4, dtype='int')
>>> print(B)
[3 3 3 3]
>>> print(C)
[1 1 1 1]
>>> print(B - C)
[2 2 2 2]
```

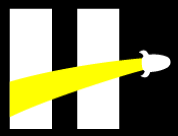


Operaciones con Arrays

Multiplicación:

```
>>> a = np.array([[2,3],[2,3],[2,3]])
>>> a.shape
(3, 2)
>>> b = np.array([[1,6,5,2,7],[1,2,7,0,9]])
>>> b.shape
(2, 5)
>>> np.matmul(a,b)
array([[ 5, 18, 31,  4, 41],
       [ 5, 18, 31,  4, 41],
       [ 5, 18, 31,  4, 41]])
>>> a@b #Similar a usar matmul()
array([[ 5, 18, 31,  4, 41],
       [ 5, 18, 31,  4, 41],
       [ 5, 18, 31,  4, 41]])
```

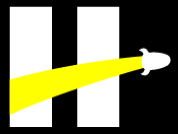
También se pueden trasponer (.T)



Operaciones con Arrays

Otros ejemplos:

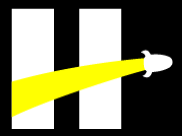
```
>>> # Aritmetica
>>> a = np.arange(4)
>>>
>>> print("a     =", a)
a     = [0 1 2 3]
>>> print("a + 5 =", a + 5)
a + 5 = [5 6 7 8]
>>> print("a - 5 =", a - 5)
a - 5 = [-5 -4 -3 -2]
>>> print("a * 2 =", a * 2)
a * 2 = [0 2 4 6]
>>> print("a / 2 =", a / 2)
a / 2 = [ 0.   0.5  1.   1.5]
>>> print("a // 2 =", a // 2)
a // 2 = [0 0 1 1]
>>> print("-a     = ", -a)
-a     =  [ 0 -1 -2 -3]
>>> print("a ** 2 = ", a ** 2)
a ** 2 =  [0 1 4 9]
>>> print("a % 2  = ", a % 2)
a % 2  =  [0 1 0 1]
```



Estadísticas

```
>>> height_list = [74, 74, 72, 72, 73, 69, 69, 71, 76, 71, 73, 73, 74, 74, 69, 70, 73, 75, 78, 79, 76, 74, 76, 72, 71, 75]
>>> print(np.mean(height_list))
73.1923076923077
>>> print(np.median(height_list))
73.0
>>> print(np.std(height_list))
2.572326554954764
>>> print(np.percentile(height_list,90))
76.0
```

```
>>> # Otras ufuncs interesantes
>>> a = np.arange(4)
>>> b = np.arange(1,5)
>>>
>>> display(np.exp(a))         # exponencial
array([ 1.        ,  2.71828183,  7.3890561 , 20.08553692])
>>> display(np.log(b))         # logaritmo natural
array([ 0.        ,  0.69314718,  1.09861229,  1.38629436])
>>> display(np.sqrt(a))        # raiz cuadrada
array([ 0.        ,  1.        ,  1.41421356,  1.73205081])
>>> display(np.greater(a,b))   # superior o igual punto a punto
array([False, False, False, False], dtype=bool)
```



Máscaras

```
>>> a = np.arange(0,20).reshape(2,10)
>>> print(a)
[[ 0  1  2  3  4  5  6  7  8  9]
 [10 11 12 13 14 15 16 17 18 19]]
>>> mascara = ((a % 2) == 0)
>>> print(mascara)
[[ True False  True False  True False  True False  True False]
 [ True False  True False  True False  True False  True False]]
>>> a[mascara]
array([ 0,  2,  4,  6,  8, 10, 12, 14, 16, 18])
```