Tensors and Tensor Arithmetic

November 2, 2020

0.0.1 EJEMPLO 1

Podemos definir un tensor usando la función `array()`.

[1]:
```
# Crear un tensor

from numpy import array
T = array([
    [[1, 2, 3], [4, 5, 6], [7, 8, 9]],
    [[11, 12, 13], [14, 15, 16], [17, 18, 19]],
    [[21, 22, 23], [24, 25, 26], [27, 28, 29]]
])
print(T.shape)
print(T)
```

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

 [[11 12 13]
  [14 15 16]
  [17 18 19]]

 [[21 22 23]
  [24 25 26]
  [27 28 29]]]
```

0.0.2 EJEMPLO 2

[4]:
```
# Suma de tensores

from numpy import array
# Definiendo el primer y segundo tensor
A = array([
    [[1, 2, 3], [4, 5, 6], [7, 8, 9]],
    [[11, 12, 13], [14, 15, 16], [17, 18, 19]],
    [[21, 22, 23], [24, 25, 26], [27, 28, 29]]
])
```

```
B = array([
    [[1, 2, 3], [4, 5, 6], [7, 8, 9]],
    [[11, 12, 13], [14, 15, 16], [17, 18, 19]],
    [[21, 22, 23], [24, 25, 26], [27, 28, 29]]
])
# Sumando los tensores
C = A + B
print(C)
```

```
[[[ 2  4  6]
  [ 8 10 12]
  [14 16 18]]

 [[22 24 26]
  [28 30 32]
  [34 36 38]]

 [[42 44 46]
  [48 50 52]
  [54 56 58]]]
```

0.0.3 EJEMPLO 3

[5]:
```
# Resta de tensores

from numpy import array
# Definiendo el primer y segundo tensor
A = array([
    [[1, 2, 3], [4, 5, 6], [7, 8, 9]],
    [[11, 12, 13], [14, 15, 16], [17, 18, 19]],
    [[21, 22, 23], [24, 25, 26], [27, 28, 29]]
])
B = array([
    [[1, 2, 3], [4, 5, 6], [7, 8, 9]],
    [[11, 12, 13], [14, 15, 16], [17, 18, 19]],
    [[21, 22, 23], [24, 25, 26], [27, 28, 29]]
])
# Restando los tensores
C = A - B
print(C)
```

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

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

```
  [0 0 0]]

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

0.0.4 EJEMPLO 4

[6]:
```
# Producto Hadamard de tensores

from numpy import array
# Definiendo el primer y segundo tensor
A = array([
    [[1, 2, 3], [4, 5, 6], [7, 8, 9]],
    [[11, 12, 13], [14, 15, 16], [17, 18, 19]],
    [[21, 22, 23], [24, 25, 26], [27, 28, 29]]
])
B = array([
    [[1, 2, 3], [4, 5, 6], [7, 8, 9]],
    [[11, 12, 13], [14, 15, 16], [17, 18, 19]],
    [[21, 22, 23], [24, 25, 26], [27, 28, 29]]
])
# Multiplicando los tensores
C = A * B
print(C)
```

```
[[[  1   4   9]
  [ 16  25  36]
  [ 49  64  81]]

 [[121 144 169]
  [196 225 256]
  [289 324 361]]

 [[441 484 529]
  [576 625 676]
  [729 784 841]]]
```

0.0.5 EJEMPLO 5

[7]:
```
# División de tensores

from numpy import array
# Definiendo el primer y segundo tensor
A = array([
    [[1, 2, 3], [4, 5, 6], [7, 8, 9]],
    [[11, 12, 13], [14, 15, 16], [17, 18, 19]],
```

```
    [[21, 22, 23], [24, 25, 26], [27, 28, 29]]
])
B = array([
    [[1, 2, 3], [4, 5, 6], [7, 8, 9]],
    [[11, 12, 13], [14, 15, 16], [17, 18, 19]],
    [[21, 22, 23], [24, 25, 26], [27, 28, 29]]
])
# Dividiendo los tensores
C = A / B
print(C)
```

```
[[[1. 1. 1.]
  [1. 1. 1.]
  [1. 1. 1.]]

 [[1. 1. 1.]
  [1. 1. 1.]
  [1. 1. 1.]]

 [[1. 1. 1.]
  [1. 1. 1.]
  [1. 1. 1.]]]
```

0.0.6 EJEMPLO 6

Es necesario usar la función `tensordot()`, la cual recibe como argumentos los dos tensores y el eje en el que se deben sumar los productos. Para calcular el producto de tensores, el eje x debe ser 0.

[8]:
```
# Producto de tensores

from numpy import array, tensordot

# Definiendo el primer y segundo vector
A = array([1, 2])
B = array([3, 4])

# Calculando el producto de tensores
C = tensordot(A, B, axes = 0)
print(C)
```

```
[[3 4]
 [6 8]]
```