

Tutorial_Numpy_Multiplication

August 24, 2022

1 A primer on Numpy Multiplication

=====

a*b

```
[ -7. -11.  -7.]  
[ -4. -26. -21.]  
[ 28. 286. 147.]
```

```
[[-12.]  
 [-11.]  
 [-20.]]  
[[ -2.]  
 [-14.]  
 [  4.]]  
[[ 24.]  
 [154.]  
 [-80.]]
```

```
[[ 2. -8. -7.]]  
[[10.]  
 [14.]  
 [15.]]  
[[ 20. -80. -70.]  
 [ 28. -112. -98.]  
 [ 30. -120. -105.]]
```

```
[[-14.]  
 [  3.]  
 [  5.]]  
[[ 1. -20. -9.]]  
[[ -14. 280. 126.]  
 [  3. -60. -27.]  
 [  5. -100. -45.]]
```

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a.dot(b)

```

[-5.  2. -8.]
[-4. 19.  6.]
10.0

[[ 7.]
 [-1.]
 [ 5.]]
[[ 9.]
 [ 8.]
 [21.]]
# ValueError: shapes (3,1) and (3,1) not aligned: 1 (dim 1) != 3 (dim 0)

[[ 2. -12.  3.]]
[[-4.]
 [14.]
 [12.]]
[[-140.]]

[[7.]
 [4.]
 [3.]]
[[ 5. -3. 11.]]
[[ 35. -21. 77.]
 [ 20. -12. 44.]
 [ 15.  -9. 33.]]

=====
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a@b

[ 2. -5.  2.]
[ 13. -14. -3.]
90.0

[[-18.]
 [ 17.]
 [ -6.]]
[[ -5.]
 [-24.]
 [ 18.]]
matmul: Input operand 1 has a mismatch in its core dimension 0, with gufunc
signature (n?,k),(k,m?)->(n?,m?) (size 3 is different from 1)

[[-13.  -0.  5.]]
[[-0.]
 [-8.]
 [-9.]]

```

```

[[-45.]]

[[-3.]
 [ 7.]
 [-1.]]
[[ 7. -1. -3.]]
[[-21.  3.  9.]
 [ 49. -7. -21.]
 [ -7.  1.  3.]]

```

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2 Matrix-Matrix and Matrix-Array Multiplication

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a*b

```

[[-13. -3.]
 [ -4. -9.]
 [ -1. -2.]]
[[ 4. -8.]
 [22. -6.]
 [12. -5.]]
[[-52. 24.]
 [-88. 54.]
 [-12. 10.]]

```

```

[[12.  6.]
 [-5. 15.]
 [25. 11.]]
[[ 7. -6.  4.]
 [-0. 10. -4.]]

```

ValueError: operands could not be broadcast together with shapes (3,2) (2,3)

```

[[12. -4.  8.]
 [-2.  7. 15.]]
[[10. 10.  8.]
 [ 4. -8.  6.]]
[[120. -40. 64.]
 [ -8. -56. 90.]]

```

```

[[-19.  5.]
 [ -7.  5.]
 [  2.  3.]]
[[-3.]
 [-3.]
 [13.]]

```

```
[[ 57. -15.]
 [ 21. -15.]
 [ 26.  39.]]
```

```
[[ -11.   2.  -1.]
 [   4. -16.  10.]]
[[ -2. -6.  15.]]
[[ 22. -12. -15.]
 [ -8.  96. 150.]]
```

```
=====
=====
```

```
a.dot(b)
```

```
[[ 16.  -3.]
 [   7. -12.]
 [   5.  18.]]
[[ -7.   5.]
 [ -6.   4.]
 [ -2.  -1.]]
```

```
ValueError: shapes (3,2) and (3,2) not aligned: 2 (dim 1) != 3 (dim 0)
```

```
[[ -12.  -2.]
 [  -3.  -1.]
 [  -2.  -3.]]
[[   5.  22.   8.]
 [  -1.   3. -10.]]
[[ -58. -270. -76.]
 [ -14.  -69. -14.]
 [  -7.  -53.  14.]]
```

```
[[   4.   3. -23.]
 [ -13.  -9.  -6.]]
[[ -2.  11.  -2.]
 [ -4.  12.  -4.]]
```

```
ValueError: shapes (2,3) and (2,3) not aligned: 3 (dim 1) != 2 (dim 0)
```

```
[[ -3.  -5.]
 [ -2.   2.]
 [-10.  22.]]
[[ -20.]
 [   2.]
 [  -3.]]
```

```
ValueError: shapes (3,2) and (3,1) not aligned: 2 (dim 1) != 3 (dim 0)
```

```
[[ -4.]
 [-15.]
 [ -6.]]
```

```

[[-14.  -4.  12.]]
[[ 56.   16. -48.]]
[ 210.   60. -180.]]
[ 84.   24. -72.]]

```

```

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=====

```

a@b

```

[[ -6.  -1.]
 [-19.  -6.]
 [ 3.  -5.]]
[[ 14.   4.]
 [ 1.   9.]
 [-16. -18.]]

```

ValueError: matmul: Input operand 1 has a mismatch in its core dimension 0, with
gufunc signature (n?,k),(k,m?)->(n?,m?) (size 3 is different from 2)

```

[[-2. 14.]
 [ 7.  8.]
 [10. -7.]]
[[-0. 10. -6.]
 [11. -8. 18.]]
[[ 154. -132. 264.]
 [ 88.    6. 102.]
 [ -77. 156. -186.]]

```

```

[[-12. 13. 20.]
 [ 11. -10. 7.]]
[[ 7. -11. -10.]]

```

ValueError: matmul: Input operand 1 has a mismatch in its core dimension 0, with
gufunc signature (n?,k),(k,m?)->(n?,m?) (size 1 is different from 3)

```

[[ 10. -14.]
 [ 9.  -8.]
 [ 8.  -6.]]
[[17.]
 [11.]
 [10.]]

```

ValueError: matmul: Input operand 1 has a mismatch in its core dimension 0, with
gufunc signature (n?,k),(k,m?)->(n?,m?) (size 3 is different from 2)

```

[[ -1.  -5. -10.]
 [ 14. -11.  1.]]
[[ -0.  -0. -29.]]

```

ValueError: matmul: Input operand 1 has a mismatch in its core dimension 0, with
gufunc signature (n?,k),(k,m?)->(n?,m?) (size 1 is different from 3)

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