Numpy Library Capabilities. Vectorized Calculation In Numpy Va Type Of Information

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ABSTRACT

The article shows the difference between vectorized and conventional in the NumPy library and clearly defining the type of data when creating data. In addition, other types of information are considered.

Keywords: vectorized, dtype, open source,tools ,Fourier transform, default.

NumPy was created in 2005 by Travis Oliphant. It is an open source project and you can use it freely.

NumPy stands for Numerical Python.

Why is the NumPy library used?

The NumPy library has powerful N-dimensional arrays. It is these N-dimensional arrays that enable vectorized computation using the NumPy library.

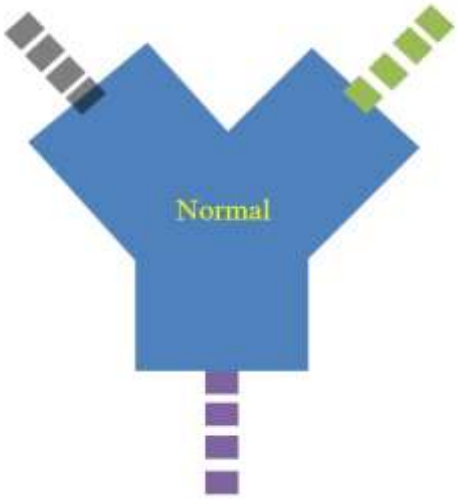
- Digital computing equipment – The NumPy library offers several additional tools. Provides tools used in mathematical functions, linear algebra functions, Fourier transforms and other fields.
- Speed of operation - The NumPy library is based on the C programming language.
- Open Source is created under the BSD license and is always free.
- Ease of use – anyone can use it easily, regardless of support.

The main reason for the popularity of the Numpy library is Vectorized computing.

Let's understand how vectorized computing differs from traditional computing.

Vectorized Calculation

Vectorized calculation – performs calculations on all elements of the data set in the form of an array at the same time.



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Rules

Data

Results

In normal calculation - it is possible to perform operations on bit data only with the help of a bit rule, and the result will be the same accordingly. If you want to perform an operation on several data in a normal calculation, you can give the rules and data sequentially and get the results sequentially.

In vectorized computing - A single rule is an obvious implementation of matches on multiple data points and multiple outputs. In a word, using vectorized calculation, it is possible to perform operations on all elements of the array at the same time and get the result at the same time. Vectorized computing allows efficient use of time and computer resources.

Let's see the difference between Python list and array calculations in the Numpy library, that is, we will compare the time taken to multiply each element of the normal and numpy arrays by 3. For this we can create Python and Numpy lists and arrays.

```
[2] import numpy as np

[3] normal_list=list(range(500000)) # a list of numbers in the normal range (0~499999).

[ ] vectorized_list=np.array(range(500000)) # numpy array (0~499999) is an array of numbers in this range
```

Time taken to multiply each element of **normal_list** by 3.

```
[11] %time for _ in range(10):[x*3 for x in normal_list]

CPU times: user 366 ms, sys: 79.8 ms, total: 445 ms
Wall time: 446 ms
```

Time taken to multiply each element of **vectorized_list** by 3.

```
[6] %time for _ in range(10):[vectorized_list*3]

    CPU times: user 9.8 ms, sys: 1.03 ms, total: 10.8 ms
    Wall time: 15 ms
```

Let's compare the time taken to calculate these two lists.

```
[7] 446/15

    29.733333333333334
```

From this result, it can be seen that the time taken for vectorized calculation is 29.7 times less than the time taken for normal calculation.

The Numpy library has special data types. You can find out this by the table below.

Data type	Classification
bool	Boolean (True or False) stored in byte format
intc	It is the same as the int data type of the C programming language
int8	Byte(from -128 to 127)
int16	Integer (from -32768 to 32767)
int32	Integer (from -2147483648 to 2147483647)
int64	Integer (from -9223372036854775808 to 9223372036854775808)
uint8	Unisgned integer (from 0 to 255)
uint16	Unisgned integer (from 0 to 65535)
uint32	Unisgned integer (from 0 to 4294967295)
uint64	Unisgned integer (from 0 to 18446744073709551)
float16	Semi-precise float: sign bit, 5 bits exponent, 10 bits mantissa
float32	Unequivocal float: sign bit, 8 bits exponent, 23 bits mantissa
float64	Double-precision float: sign bit, 11 bits exponent, 52 bits mantissa
complex64	A complex number, is formed using two 32-bit floats.
complex128	A complex number, is formed using two 64-bit floats.
string	ASCII string type (1 byte per character)

When we should pay attention to data types in data creation and work process, and when we should not pay attention, we will see through the code how to clearly indicate the data type in Numpy and cast it to another data type.

What is the point of dividing the Integer data type by the number of bits like (int8,int16,int32,int64)? This is the advantage of the Numpy library. This advantage allows us to control where this data is occupied in memory when performing operations in the Numpy library. We will understand this through an example.

You have 1.5 million data, and each element of this data is an integer, and if we imagine that these integers are int16 (-32768 to 32787), we can save some memory if we specify the data type int16 when creating the data. because if the data is generated from Integer numbers, by default, data is created in the int64 data type.

When creating information, we will see through the code how to specify its data type.

```
[ ] import numpy as np
```

```
[27] array1 = np.array([1,2,3,4,5,6,7]) # which is an array with an int64 data type
     array1.dtype # We can find out the data type using the .dtype attribute.

     dtype('int64')
```

```
array2=np.array(array1,dtype=(np.int16)) # We transfer the array1 to the int16 data type
array2.dtype

dtype('int16')
```

Changing the data type, i.e. switching from the Integer data type to the Float data type, we will see through the code, this is done using the astype() method.

```
[23] array3=array1.astype(np.float64)
     array3.dtype

     dtype('float64')
```

Working with data types enables efficient memory redirection and data manipulation.

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