NumPy Data Types

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Data Types in Python

By default Python have these data types:

- `strings` - used to represent text data, the text is given under quote marks. eg. "ABCD"
- `integer` - used to represent integer numbers. eg. -1, -2, -3
- `float` - used to represent real numbers. eg. 1.2, 42.42
- `boolean` - used to represent True or False.
- `complex` - used to represent a number in complex plain. eg. 1.0 + 2.0j, 1.5 + 2.5j

Data Types in NumPy

NumPy has some extra data types, and refer to data types with one character, like `i` for integers, `u` for unsigned integers etc.

Below is a list of all data types in NumPy and the characters used to represent them.

- `i` - integer
- `b` - boolean
- `u` - unsigned integer
- `f` - float
- `c` - complex float
- `m` - timedelta
- `M` - datetime
- `O` - object
- `S` - string

- `U` - unicode string
- `V` - fixed chunk of memory for other type (void)

Checking the Data Type of an Array

The NumPy array object has a property called `dtype` that returns the data type of the array:

Example

Get the data type of an array object:

```
import numpy as np

arr = np.array([1, 2, 3, 4])

print(arr.dtype)
```

Try it Yourself »

Example

Get the data type of an array containing strings:

```
import numpy as np

arr = np.array(['apple', 'banana', 'cherry'])

print(arr.dtype)
```

Try it Yourself »

Creating Arrays With a Defined Data Type

We use the `array()` function to create arrays, this function can take an optional argument: `dtype` that allows us to define the expected data type of the array

elements:

Example

Create an array with data type string:

```
import numpy as np

arr = np.array([1, 2, 3, 4], dtype='S')

print(arr)
print(arr.dtype)
```

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For `i`, `u`, `f`, `S` and `U` we can define size as well.

Example

Create an array with data type 4 bytes integer:

```
import numpy as np

arr = np.array([1, 2, 3, 4], dtype='i4')

print(arr)
print(arr.dtype)
```

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What if a Value Can Not Be Converted?

If a type is given in which elements can't be casted then NumPy will raise a ValueError.

ValueError: In Python ValueError is raised when the type of passed argument to a function is unexpected/incorrect.

Example

A non integer string like 'a' can not be converted to integer (will raise an error):

```
import numpy as np

arr = np.array(['a', '2', '3'], dtype='i')
```

Try it Yourself »

Converting Data Type on Existing Arrays

The best way to change the data type of an existing array, is to make a copy of the array with the `astype()` method.

The `astype()` function creates a copy of the array, and allows you to specify the data type as a parameter.

The data type can be specified using a string, like `'f'` for float, `'i'` for integer etc. or you can use the data type directly like `float` for float and `int` for integer.

Example

Change data type from float to integer by using `'i'` as parameter value:

```
import numpy as np

arr = np.array([1.1, 2.1, 3.1])

newarr = arr.astype('i')

print(newarr)
print(newarr.dtype)
```

Try it Yourself »

Example

Change data type from float to integer by using `int` as parameter value:

```
import numpy as np

arr = np.array([1.1, 2.1, 3.1])

newarr = arr.astype(int)

print(newarr)
print(newarr.dtype)
```

Try it Yourself »

Example

Change data type from integer to boolean:

```
import numpy as np

arr = np.array([1, 0, 3])

newarr = arr.astype(bool)

print(newarr)
print(newarr.dtype)
```

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