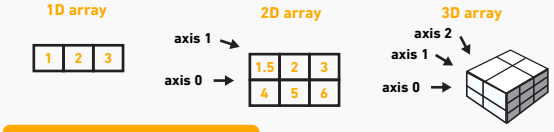
NumPy Basics Cheat Sheet

BecomingHuman.AI

DataCamp

NumPy

The NumPy library is the core library for scientific computing in Python. It provides a high-performance multidimensional array object, and tools for working with these arrays.



Creating Arrays

```
>>> a = np.array([1,2,3])
>>> b = np.array([(1.5,2,3), (4,5,6)], dtype = float)
>>> c = np.array([[(1.5,2,3), (4,5,6)], [(3,2,1), (4,5,6)]],dtype = float)
```

Initial Placeholders

```
>>> np.zeros((3,4))                    Create an array of zeros
>>> np.ones((2,3,4),dtype=np.int16)    Create an array of ones
>>> d = np.arange(10,25,5)             Create an array of evenly spaced values (step value)
>>> np.linspace(0,2,9)                 Create an array of evenly spaced values (number of samples)
>>> e = np.full((2,2),7)               Create a constant array
>>> f = np.eye(2)                      Create a 2X2 identity matrix
>>> np.random.random((2,2))            Create an array with random values
>>> np.empty((3,2))                    Create an empty array
```

I/O

Saving & Loading On Disk

```
>>> np.save('my_array', a)
>>> np.savez('array.npz', a, b)
>>> np.load('my_array.npy')
```

Saving & Loading Text Files

```
>>> np.loadtxt("myfile.txt")
>>> np.genfromtxt("my_file.csv", delimiter=",")
>>> np.savetxt("myarray.txt", a, delimiter=" ")
```

Inspecting Your Array

```
>>> a.shape          Array dimensions
>>> len(a)           Length of array
>>> b.ndim           Number of array dimensions
>>> e.size           Number of array elements
>>> b.dtype          Data type of array elements
>>> b.dtype.name     Name of data type
>>> b.astype(int)    Convert an array to a different type
```

Data Types

```
>>> np.int64         Signed 64-bit integer types
>>> np.float32       Standard double-precision floating point
>>> np.complex       Complex numbers represented by 128 floats
>>> np.bool          Boolean type storing TRUE and FALSE
>>> np.object        Python object type values
>>> np.string_       Fixed-length string type
>>> np.unicode_      Fixed-length unicode type
```

Asking For Help

```
>>> np.info(np.ndarray.dtype)
```

Array Mathematics

Arithmetic Operations

```
>>> g = a - b                          Subtraction
  array([[-0.5, 0. , 0. ],
         [-3. , -3. , -3. ]])
>>> np.subtract(a,b)                   Subtraction
>>> b + a                              Addition
  array([[ 2.5, 4. , 6. ],
         [ 5. , 7. , 9. ]])
>>> np.add(b,a)                        Addition
>>> a / b                              Division
  array([[ 0.66666667, 1. , 1. ],
         [ 0.25 , 0.4 , 0.5 ]])
>>> np.divide(a,b)                     Division
>>> a * b                              Multiplication
  array([[ 1.5, 4. , 9. ],
         [ 4. , 10. , 18. ]])
>>> np.multiply(a,b)                   Multiplication
>>> np.exp(b)                          Exponentiation
>>> np.sqrt(b)                         Square root
>>> np.sin(a)                          Print sines of an array
>>> np.cos(b)                          Element-wise cosine
>>> np.log(a)                          Element-wise natural logarithm
>>> e.dot(f)                           Dot product
  array([[ 7., 7.],
         [ 7., 7.]])
```

Comparison

```
>>> a == b                             Element-wise comparison
  array([[False, True, True],
         [False, False, False]], dtype=bool)
>>> a < 2                              Element-wise comparison
  array([True, False, False], dtype=bool)
>>> np.array_equal(a, b)               Array-wise comparison
```

Aggregate Functions

```
>>> a.sum()                            Array-wise sum
>>> a.min()                            Array-wise minimum value
>>> b.max(axis=0)                      Maximum value of an array row
>>> b.cumsum(axis=1)                   Cumulative sum of the elements
>>> a.mean()                           Mean
>>> b.median()                         Median
```

Copying Arrays

```
>>> h = a.view()          Create a view of the array with the same data
>>> np.copy(a)            Create a copy of the array
>>> h = a.copy()          Create a deep copy of the array
```

Sorting Arrays

```
>>> a.sort()              Sort an array
>>> c.sort(axis=0)        Sort the elements of an array's axis
```

Subsetting, Slicing, Indexing

Subsetting

```
>>> a[2]                  Select the element at the 2nd index
  3
>>> b[1,2]                Select the element at row 1 column 2 (equivalent to b[1][2])
  6.0
```

Slicing

```
>>> a[0:2]                Select items at index 0 and 1
  array([1, 2])
>>> b[0:2,1]              Select items at rows 0 and 1 in column 1
  array([ 2., 5.])
>>> b[:1]                 Select all items at row 0 (equivalent to b[0:1, :])
  array([[1.5, 2., 3.]])
>>> c[1,...]              Same as [1,:,:]
  array([[[ 3., 2., 1.],
          [ 4., 5., 6.]]])
>>> a[ : :-1]             Reversed array a
  array([3, 2, 1])
```

Boolean Indexing

```
>>> a[a<2]                Select elements from a less than 2
  array([1])
```

Fancy Indexing

```
>>> b[[1, 0, 1, 0],[0, 1, 2, 0]]   Select elements (1,0),(0,1),(1,2) and (0,0)
  array([ 4. , 2. , 6. , 1.5])
>>> b[[1, 0, 1, 0]][:,[0,1,2,0]]   Select a subset of the matrix's rows and columns
  array([[ 4. , 5. , 6. , 4. ],
         [ 1.5, 2. , 3. , 1.5],
         [ 4. , 5. , 6. , 4. ],
         [ 1.5, 2. , 3. , 1.5]])
```

Array Manipulation

Transposing Array

```
>>> i = np.transpose(b)   Permute array dimensions
>>> i.T                   Permute array dimensions
```

Changing Array Shape

```
>>> b.ravel()             Flatten the array
>>> g.reshape(3,-2)       Reshape, but don't change data
```

Adding/Removing Elements

```
>>> h.resize((2,6))       Return a new array with shape (2,6)
>>> np.append(h,g)         Append items to an array
>>> np.insert(a, 1, 5)     Insert items in an array
>>> np.delete(a,[1])       Delete items from an array
```

Splitting Arrays

```
>>> np.hsplit(a,3)        Split the array horizontally at the 3rd
  [array([1]),array([2]),array([3])] index
>>> np.vsplit(c,2) Split the array   vertically at the 2nd index
  [array([[[ 1.5, 2. , 1. ],
           [ 4. , 5. , 6. ]]]),
```

Combining Arrays

```
>>> np.concatenate((a,d),axis=0)   Concatenate arrays
  array([ 1, 2, 3, 10, 15, 20])
>>> np.vstack((a,b))               Stack arrays vertically (row-wise)
  array([[ 1. , 2. , 3. ],
         [ 1.5, 2. , 3. ],
         [ 4. , 5. , 6. ]])
>>> np.r_[e,f]                     Stack arrays vertically (row-wise)
>>> np.hstack((e,f))               Stack arrays horizontally (column-wise)
  array([[ 7., 7., 1., 0.],
         [ 7., 7., 0., 1.]])
>>> np.column_stack((a,d))         Create stacked column-wise arrays
  array([[ 1, 10],
         [ 2, 15],
         [ 3, 20]])
>>> np.c_[a,d]                     Create stacked column-wise arrays
```