

KEY_Lesson20_Numpy_Intro

January 11, 2020

1 Introduction to Numpy

RECAP: You have previously learned how to manipulate data with the **pandas** library.

Today, we will be learning how to perform calculations with another library known as **numpy**. **numpy** allows you to do math on entire lists of data, all at the same time!

Let's **create a list containing the numbers 0 through 5** and assign it to a variable:

```
[0]: # Create a list containing the numbers 0 through 4
data = [0, 1, 2, 3, 4]

# or convert the range to a list
data = list(range(5))
```

```
[2]: # let's see what it looks like
print(data)
```

```
[0, 1, 2, 3, 4]
```

Using lists can be really useful, because you can store any set of data in the list.

Now, lets **add 1 to each of the items in the list**. Is there a simple way to do this?

```
[3]: data + 1
```

```

      □
↳-----

TypeError                                Traceback (most recent call↳
↳last)

    <ipython-input-3-1943d790f594> in <module>()
----> 1 data + 1

TypeError: can only concatenate list (not "int") to list
```

hmm ... that didn't work! That is because **the + operator acts as a concatenation operator** on lists, and we learned previously that we can only concatenate lists with lists, not with integers.

Another way we could update our list is to add 1 to each of the items in the list individually. We can do this by **indexing to isolate each value** in the list one by one.

```
[0]: # Add 1 to each item in the array you created above
data[0] = data[0] + 1
data[1] = data[1] + 1
data[2] = data[2] + 1
data[3] = data[3] + 1
data[4] = data[4] + 1

# print the list to see how it changed
print(data)
```

This is very inconvenient with a list. It is more useful with a single number, where you can do something like this to add a number:

```
[0]: # create a single variable and add a number to it
a = 5
a += 1
print(a)
```

Today we will be using **numpy**, which allows us to quickly and efficiently perform mathematical operations on entire lists (or, as they're called in **numpy**, *arrays*)!

First we will **import numpy**. Remember when we imported **pandas**, we gave it the special nickname **pd**? We're also going to give **numpy** a nickname: **np**:

```
[0]: # Load numpy
import numpy as np
```

Now whenever we type **np**, **python** will know we really mean **numpy**.

There is a ton of useful stuff we can do with **numpy**, so let's **redo the example above using numpy arrays** instead of lists.

```
[0]: # create a numpy array containing the numbers 0 through 4
data_array = np.array([0, 1, 2, 3, 4])

# you can print arrays just like lists
print(data_array)
```

Numpy arrays act very similarly to regular python lists, **we can grab individual items using the same syntax**:

```
[0]: # Print any number from the numpy array you just created:
print(data_array[0])
```

Numpy arrays also add a lot of useful features such as the ability to perform commands *on all items in a list at the same time*.

We can demonstrate this by **adding a number to all of the items in the Numpy array**:

```
[0]: # Add any number to the array we created above
data_array += 5

# print the array
print(data_array)
```

See how much easier that was than manually changing each element of a list? We will be using numpy a lot to perform calculations on arrays of data. In the above example we used addition, but you can also perform any mathematical operation we've talked about with numpy arrays.

In this lesson you learned how to: * Load numpy into Python. * Create an array with numpy. * Perform math with numpy arrays.