Background on NumPy

NumPy is a multi-dimensional array library.

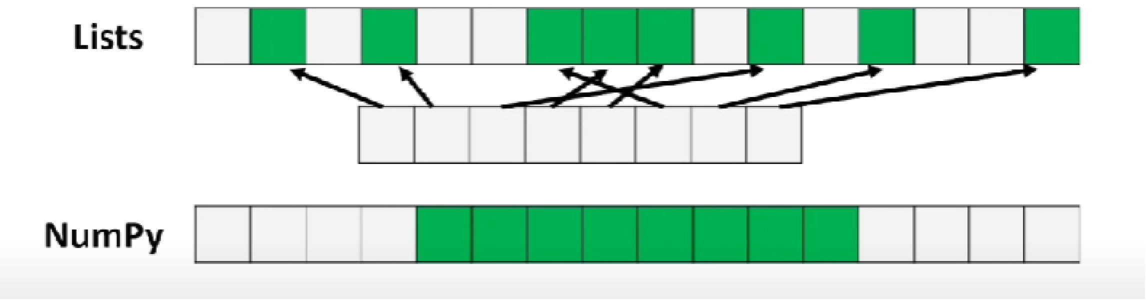
We can make 1,2,3,.., n dimensional array.

NumPy vs Lists

1. NumPy is very fast compared to lists.
2. NumPy uses fixed types (accommodates only one type of data, ARRAY) as we could specify how many bits to be used for storing a certain number.
3. For example; you can store things as `int16` or `int8`
4. Lists store a lot more things than arrays. They include
    a. Size
    b. Reference Count
    c. Object Type
    d. Object Value

    A single integer within a list would require a lot more room for storage given the amount of information python stores. Hence, NumPy is just faster because

    - Faster to read less bytes of memory
    - No type checking when iterating through objects as lists check for the data type of each element before iterating
    - NumPy arrays use contiguous memory;



Lists store things as points to various memory locations which are discrete

NumPy arrays store things in a continuous manner which makes accessing data much faster.

The benefit is that is allows the CPU to use Single Instruction Multiple Data (SIM-D) Vector Processing.

- Multiple computations can be done simultaneously because of this
- Cache memory (an auxiliary memory from which high speed retrieval is possible) allocation is more effectively utilized as things are not scattered around like lists
- In lists we can do insertion, deletion, appending, concatenation and etc. In NumPy we can do all of that but a lot more. For example, we can multiple the corresponding elements of an array using NumPy but lists cannot be multiplied

Applications of NumPy

1. It is a good replacement of the MATLAB replacement. (SciPy is even better)
2. Works well with Matplotlib for plotting
3. Works in a lot of backend libraries like Pandas, Connect 4, Digital Photography
4. Pretty important for Machine Learning applications. The concept of tensors in ML is highly connected to NumPy.