

Numpy cheat sheet

HowTo:

- This cheat sheet is supposed to give a short broad overview over important numpy functions and provides hyperlinks to the full documentation of each function. If you are completely new to numpy you might want to check out **this** short tutorial

General array properties:

- `ndarray.shape` Returns the shape of given array (as **tuple**). Useful for debugging and to create new arrays of this shape.
- `ndarray.size` Returns the product of the array dimensions (as **scalar**). Might be useful for reshaping.

Creating arrays:

- `np.zeros(shape)` Creates an array with specified shape (**tuple**) filled with zeros
- `np.ones(shape)` Creates an array with specified shape (**tuple**) filled with ones
- `np.zeros_like(array)` Creates an array with the shape of the inputarray (**ndarray**) filled with zeros
- `np.arange(start, stop, stepsize)` Creates an array by counting from start until stop with specified stepsize (all **int**) start and stepsize are optional
- `np.linspace(start, stop, numelements)` Creates an array by creating as many elements as numelements between start and the stoppoint (all **int**)
- `np.meshgrid(x1, x2, ..., xN)` Creates N N -D arrays, each containing a coordinate grid for the respective dimension, from N 1-D coordinate arrays.

Array handling:

- `np.reshape(array, newshape)` Reshapes the array to specified newshape (**tuple**)
- `np.vstack(tuple)` Stacks two arrays (as **tuple**) vertically (horizontal equivalent: `np.hstack(tuple)`)
- `np.concatenate((array1,array2,...), axis = 0)` Concatenates arrays with exact same shape - except for the dimension of "axis".
- `np.tile(array, numberofrepetitions)` Creates an array by repeating the specified array numberofrepetitions times (**tuple**)
- `ndarray.T` Transpose the numpy array

Calculating with numpy arrays:

- `np.dot(array1,array2)` Dot product of two arrays
- Elementwise multiplication \rightarrow `array1 * array2`
- All other mathematical operations
- Masking: "`array < scalar`" returns a boolean mask of where all array values are smaller then the scalar

Array indexing

- `[2 : 8]`
start|end
- `[2 : 8 : 2]`
start|end|stepsize \rightarrow can be used for subsampling
- `[2 : 8 , :]`
start|end|2nd dimension
- `[... , -1]`
all other dims|last dimension
- Negative values can be used to walk backwards or to access the last elements of an array
- `[:,1]` returns an array with dim 1 while `[:,1 : 2]` returns the same array with dim 2

Statistics

- `np.amax(array)/ np.amin(array)` calculates the max/min value of an array
- `np.argmax(array)/ np.argmin(array)` returns the index of the max/min value of an array
- `np.mean(array,axis)/ np.std(array,axis)` calculates the mean/standard deviation of an array along specified axis

Important functions from other libraries

- `scipy.signal.convolve(array,kernel)/ scipy.signal.correlate(array,kernel)` N-dimensional convolution/correlation of an array with specified kernel. You might want to use `np.pad(array,pad_width)` to resize your array after convolving
- Use pickle to save (`pickle.dump(data, open(filename, "wb"))`) or load (`pickle.load(open(filename, "rb"))`) any kind of object

Other pointers:

- Setting up python via (Ana-/Mini-)conda for Windows/macOS/Linux
- Setting up a virtual environment Recommended!
- Pycharm is an easy to use IDE for python. Can be assessed in the cip-pool by typing `<addpackage pycharm>` in the terminal