Lecture 3

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NumPy

Buntspecht / Great Spotted Woodpecker

(*Dendrocopos major, Syn.: Picoides major*)

- Medium-sized woodpecker with pied black and white plumage and a red patch on the lower belly. Males and young birds also have red markings on the neck or head.
- Great spotted woodpeckers chisel into trees to find food or excavate nest holes, and also drum for contact and territorial advertisement.
- Like other woodpeckers, they have anatomical adaptations to manage the physical stresses from the hammering action.
- The call of the great spotted woodpecker is a sharp *kik*, which may be repeated as a wooden rattling *krrarraarr* if the bird is disturbed.
- The great spotted woodpecker spends much of its time climbing trees.

Sources:
* Photo by Josef Gadermaier on pixabay
* https://en.wikipedia.org/wiki/Great_spotted_woodpecker

Data Science

NumPy

1. Library Overview
2. Arrays & Indexing
3. Array Math & Broadcasting

Important Python Libraries for Data Science

NumPy - *"The fundamental package for scientific computing with Python"*

- POWERFUL N-DIMENSIONAL ARRAYS
  - Fast and versatile, the NumPy vectorization, indexing, and broadcasting concepts are the de-facto standards of array computing today.
- NUMERICAL COMPUTING TOOLS
  - NumPy offers comprehensive mathematical functions, random number generators, linear algebra routines, Fourier transforms, and more.
- PERFORMANT
  - The core of NumPy is well-optimized C code. Enjoy the flexibility of Python with the speed of compiled code.
- EASY TO USE
  - NumPy's high level syntax makes it accessible and productive for programmers from any background or experience level.

Full Documentation:
https://numpy.org/

Source: https://numpy.org/

ndarray and dtype

- Provides n-dimensional array object & routines for fast operations on ndarrays
  - all elements in the array required to be of the same data type
  - fixed size at creation
  - most operations performed in compiled C code for performance
- NumPy's array class is called `ndarray` (alias `array`)
  - Note: `numpy.array` is not the same as the Standard Python Library class `array.array`!
- Important attributes of an `ndarray` object:
  - `ndarray.ndim`: number of axes (dimensions) of the array.
  - `ndarray.shape`: dimensions of the array: tuple of integers indicating the size of the array in each dimension.
    - For a matrix with *n* rows and *m* columns, shape will be (n,m).
    - Length of the shape tuple is therefore the number of axes (ndim).
  - `ndarray.dtype`: object describing the type of the elements in the array, e.g. `numpy.int64`, `numpy.float64`

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Demo

Demo

NumPy Arrays and Indexing

Source: Foto von Markus Spiske auf Unsplash

Exercise

Exercise 1

NumPy - Part 1

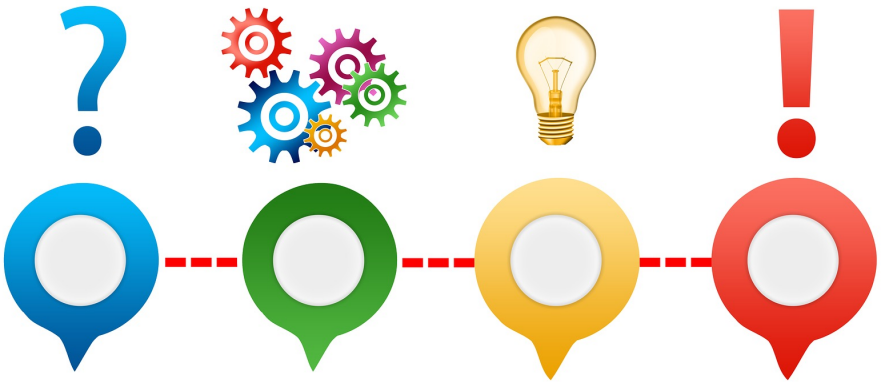

Photo by Gerd Altmann on Pixabay

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NumPy Array Math and Broadcasting

Source: Foto von Markus Spiske auf Unsplash

Key Takeaways

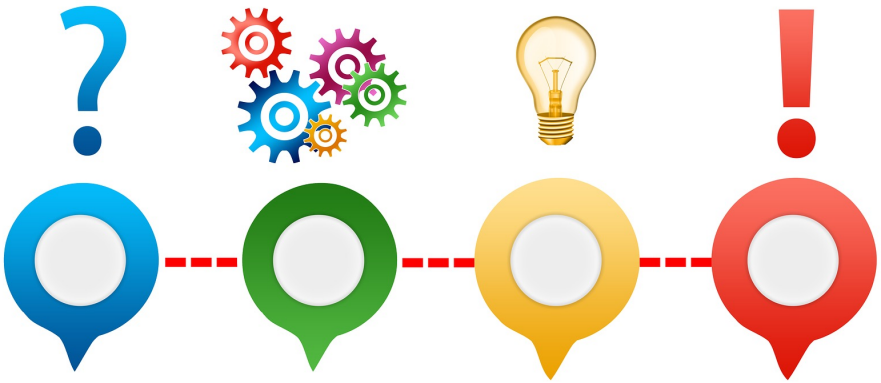
- Python Libraries for Data Science
  - NumPy, pandas, Matplotlib, seaborn, scikit-learn
- NumPy data structure (nd)array
  - Creating ndarrays
  - Indexing ndarrays, specifically integer and Boolean indexing
  - Math operations on ndarrays
  - Broadcasting

Image by Gordon Johnson on pixabay

Exercise

Exercise 2

NumPy – Part 2



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