

Laboratory – Repetition

Vectorization

NumPy allows you to express many kinds of data processing tasks as concise array expressions. This is called vectorization. They tend to be orders of magnitude faster than operations involving Python loops. In the first little exercise, we are going to visualize a simple two-dimensional function.

1. Remember `np.arange` with the strange spelling? It gives a numpy array starting with the first parameter, ending with the second parameter, and each element incremented by the step size, which is the third parameter. Create an array with 1000 values starting at -5.0 and going up to 4.99 with a step size of 0.01.
2. Use the `np.meshgrid` method in NumPy that creates a cartesian product of the arrays that it is being given. Save the result as a tuple as in

```
xs, ys = np.meshgrid(array, array)
```

3. Create a grid of values by using a NumPy u-function. Here, we are going to use $z = \sqrt{x^2 + y^2}$. You just set a variable `z` to `np.sqrt(xs**2+ys**2)`.
4. Import `matplotlib.pyplot` as `plt`.
5. Use `plt.imshow(z)` to generate a figure.
6. Use `plt.colorbar()` to show the encoding.
7. Use `plt.title` to set the title. You can use Latex notation for the formula as in

```
 $\sqrt{x^2+y^2}$ 
```

8. Do not forget `plt.show()` in your code to actually display the image. This is not necessary if you are using Jupyter notebooks.
9. Repeat the exercise with the functions $z = \sin(x^2 + 5y^2)$ and $z = \frac{xy}{x^2 + y^2}$.