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Tartalomjegyzék

Exercises

Introduction

Some exercises to get used to numpy

1. Make a vector of length 10 with elements all zero! Then modify its 4th element to 1 *(zeros)*
2. Make a 3-by-3 matrix with elements ranging from 0 up to 8 *(reshape)*
3. Make a random vector of length 30 containing random number between 0 to 1! Calculate its average and standard deviation! *(rand, mean, std)*
    1. Make a random vector of the same length with elements between -3 and 2!
4. Make a random unit vector in 5 dimensions! First make a random vector in 5 dimensions and then normalize it to unit length!

Monte-Carlo

Generate 500000 random points in the rectangle $[0,2]\times[0,4]$. Count how many of the points (x,y) have the property that $x^2 > y$. Use this to approximate the integral $\int_0^2 x^2 dx$ Like in the end of the lecture.

Numeric integral

Estimate the integral of e^{-x^2} on the interval $[-2,5]$ with the left Riemann sum!

Gradient descent

Let's have a vector-to-scalar function $f(x,y) = x^2 + y^2$. Starting from $(x_0,y_0) = (-1,-1)$ we will wind the minimum of the function. A gradient step is when you subtract the $\nabla f(x,y)\cdot\epsilon$ from the (x,y) point. If you do this for small many times then the point will converge a point where you cannot increase the function value any more, i.e. the gradient is zero. This way you can find the minimum of the function (it will be $(x,y) = (0,0)$).

- Store each step along the way, and plot them with matplotlib!

Numeric derivative

Plot the function sin(x) and its derivative on the interval [− ,]. Calculate the derivative with finite difference method!

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