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Tartalomjegyzék

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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 $x > y$. 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 find 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 ϵ 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 $[-\pi, \pi]$. Calculate the derivative with finite difference method!

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