

Tutorial 1

In this tutorial we will recapitulate memory management and consider how memory access patterns can affect performance on the CPU.

- 1.) Download the [skeleton code](#) and generate the build system using `cmake` (Under Linux and MacOS you can use a package manager (apt, brew, port,...) to install `cmake`. Then type `cmake ..` in a directory `./build` on the command line to generate the make file. On Windows `cmake -G "Visual Studio 12" .\build` generates a Visual Studio solution).
- 2.) Allocate an array `data` for storing `data_size * data_size` elements of type `int` on the heap using `malloc()`. Ensure that the program correctly cleans up the memory.
- 3.) Initialize the memory so that the i -th element of `data` has value i .
- 4.) In the following we interpret the array `data` as being two-dimensional of size `data_size × data_size`. Implement that each element of the array is squared by traversing `data` with two nested loops
 - i.) in row-major order;
 - ii.) in column-major order.(A pragma to switch between the modes, as in the skeleton code, is sufficient.)
- 5.) Measure the performance for the part implemented in 4.) for arrays of size 2^j with $j = 3 \dots 10$ for column- and row-major order, respectively. (It might be convenient to adjust the variable `k` that controls the number of repetitions of the experiment for this task). Interpret the graph.

Please finish the implementation until next week (week of 23/10/2019).