

# Internship Task

June 14, 2022

## 1 Problem

Your task is to implement the multiplication of a sparse matrix  $M$  by a sparse vector  $v$  in C++. So it's simply  $y = M.v$  and  $y$  is going to be a sparse vector as well. The goal of your implementation is to have the fastest runtime possible.

## 2 Basic Road Map

The basic road map is as follows:

- Dense implementation
- Sparse implementation (different methods / underlying algorithms)
- Parallelization
- Vectorization (SIMD)

Creativity, different approaches to problem, and comparisons are encouraged.

## 3 What to Email

A zip file including:

- Short report containing plots of:
  - Runtime of different steps
  - Comparisons of runtimes for different steps / methods / competitors
  - Explanation in text format if necessary
- Your code files
- Readme file explaining how I should compile and run your code

Plots can include various **sparsity** values for matrix and/or vector (as x-axis) and fixed for the other one and **runtime** (as y-axis) (or any other x and y axis that you think is worth to be presented).