Simulations using Reduced Numerical Precision

Testing simulations (Monte-Carlo or Molecular Dynamics) based on custom low-precision real number representations.

In the age of the end of the Moore’s Law, various approaches are considered to bypass the physical limitations of chip manufacturing and bring ever higher computer performance. One approach is to reduce the precision of floating-point numbers. Currently, most MC/MD codes use either 32 or 64-bit precision for their calculations. Recently, however, [1] showed that reduced precision, down to only 14-bit, using stochastic rounding, is sufficient for image classification.

As simulations can be very computationally expensive (months on supercomputers), the goal of this project is to verify if methods used in [1] can be applied to MC/MD, i.e. if reduced precision can provide reasonably accurate results.

This project can be adapted to BSc or MSc level.


PREREQUISITES
Programming in C/C++
Experience with MD (optional)

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In the CSE Lab, we combine computational methods, computer science tools and domain specific knowledge to solve scientific and engineering problems in areas such as Fluid Mechanics, Nanotechnology and Life Sciences. The core computational competences of our group are in particle methods and in stochastic optimization techniques. Motivated by challenges in application fields, we focus on identifying the common elements among computational techniques and on formulating common methodological, algorithmic and software structures that facilitate their further development.