Master Project

Domain-specific Loop Perforation

Description

Approximate Computing can leverage the gap between the accuracy provided by a system and the accuracy that is actually required for an application. Many applications are resistant to some amount of error as shown, e.g., machine learning, video or audio signal processing and therefore are candidates for optimization by approximation.

Loop perforation [1] is a purely software-based approximation approach that lowers computational cost by skipping some iterations of a loop. Loop perforation is a general technique and can be used to speedup different types of applications. However, recent research [2] shows, that depending on which part of an application is affected by approximation, very different results can be observed. Another image processing work [3] showed that skipping certain, particular expensive to calculate samples, can be skipped and later approximated with negligible impact on the quality of the result.

Objective

In this master project domain-specific perforation of loops shall be investigated. One example are operations that introduce only a small change of the result, such as multiplication with constants near 1 or addition of near 0 values.

The objective of this master project is two-fold:

1. Exploration of possible candidate operations and the effect on the accuracy of the result.
2. Implementation of an optimizing LLVM compiler pass that performs the approximating optimizations.

Required Skills

- ability to work self-sufficient and independent
- profound C++ experience
- intermediate compiler construction skills, preferably LLVM development experience

References


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