Towards Designing and Implementing Approximate Accelerators

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Error Estimation

The design of approximate accelerators, particularly using approximate arithmetic circuits, requires methods to estimate the accuracy at the output.

- How the errors introduced by an approximate addition propagate up to the output?
- How these and other errors interact with other accurate and approximate computations.
- Models to define how errors propagate are required.

Estimations need to produce comparable results as those obtained with exhaustive simulations and reduced data sets.

Selective Error Correction

Although approximate computing exploits inherent error tolerance in applications, an accuracy limit must be defined and satisfied [1].

- Predictor estimates if, for a given data, the accelerator would produce an error above a defined threshold.
- Re-computations to correct errors reduce application speedup.

Not all errors can be detected and corrected as accelerator speedup would be significantly reduced [2].

Our contribution

Goal: Automate the accuracy evaluation of approximate designs without requiring exhausting simulations [1].

- Software model of accelerator is used.
- Pragma annotations are used to indicate approximate operations.
- DFG representation is extracted from LLVM IR.
- Then analysis is performed.

Application: Gaussian filter.