Chair for Integrated Systems
TUM Department of Electrical and Computer Engineering
Technical University of Munich

Forschungspraxis

Investigation of state-of-the-art optimization approaches for approximate computing

The increased demands for technological advancements in computing systems in applications domains such as signal or image processing lead to the idea of approximate computing. Approximate computing provides a new design paradigm by performing inexact calculations instead of the actual one and exploiting the resilience of applications to this inexactness. As a result, fewer resources are used on the computing devices, more functions can be implemented, and the energy efficiency of the calculations is improved. Many approximation techniques have been proposed over the last decades and combining multiple of them in a larger system can increase the resulting benefits. However, this leads to a design space exploration problem to determine the best parametrization across all the employed methods. Many pieces of research have been already proposed metaheuristic optimization approaches to determine the trade-off between the benefits of approximations and loss of application quality and thereby determining the best parametrization [1] [2] [3].

This research practice aims to implement state-of-the-art optimization approaches used for determining the trade-off between approximation benefits and loss of application quality with an image processing pipeline specified in [1].

[1] M. Manuel, A. Kreddig, S. Conrady, N. A. V. Doan, and W. Stechele, Model-Based Design Space Exploration for Approximate Image Processing on FPGA, DOI:10.1109/NorCAS51424.2020.9265138.

[2] B. S. Prabakaran, V. Mrazek, Z. Vasicek, L. Sekanina, M. Shafique, ApproxFPGAs: Embracing ASIC-Based Approximate Arithmetic Components for FPGA-Based Systems, DOI:10.1109/DAC18072.2020.9218533.

[3] J. Castro-Godınez, J. Mateus-Vargas, M. Shafique, J. Henkel, AxHLS: Design space exploration and high-level synthesis of approximate accelerators using approximate functional units and analytical models, DOI:10.1145/3400302.3415732.

Prerequisites

- Basic understanding of metaheuristics optimization approaches such as genetic algorithms, tabu search, hill-climbing algorithm, etc.
- Good programming skills in Python or Matlab
- High motivation and ability to work independently.

Contact

Manu Manuel
Email:manu.manuel.tum.de

Advisors

Manu Manuel