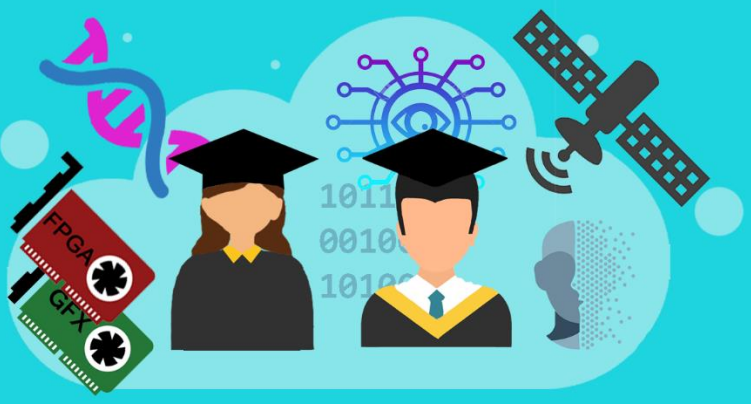
Diploma Thesis

Microproccessors and Digital Systems Laboratory



Building QoR models from a GitHub based HLS knowledge base

Nowadays, High-Level Synthesis (HLS) is used more and more for the design of HW because it offers a faster and more flexible development process compared to the traditional RTL approach. With HLS, developers instruct the compiler how to perform synthesis by adding directives to a C/C++ or OpenCL source code. However, manually selecting the appropriate HLS directives is a difficult task even for human experts, mainly because of i) the huge decision space and ii) their inherent correlation with the underlying FPGA architecture. The lack of tools that provide optimized and device-specific HLS directives in an automated manner is therefore one of the major constraints preventing the realization of the FPGA Automatic Code Deployment (ACD) vision.

Automatically providing optimized and device-specific HLS directives for a given application and a target FPGA has always been an ambitious goal pursued by numerous engineers and scientists. Several research efforts have been proposed to address the challenges of automatic HLS directives design space exploration. One of the main approaches is to develop models that provide the Quality of Result (QoR) metrics, i.e., latency and resources, for an unknown combination of application and directives without using the time-consuming synthesis tool chains. The main problem is the lack of representative HLS application knowledge bases to train the QoR models, since most researchers use well-known benchmark suites (e.g., Rodinia, Machsuite) that are not able to capture all the different source code structures that designers use in practice.

In this work, we will build a knowledge base for High Level Synthesis kernel. As a first step, we will search publicly available repositories on GitHub, specify the kernel, and analyze the source code. Natural language processing techniques will be used to gain insight into the source code. Finally, we will use these features to build various Machine Learning and/or Deep Learning models to predict different QoR metrics.

PREREQUISITES:

Strong knowledge of **High Level Synthesis**, **C/C++**, **Python**, **Bash Scripting**

Desirable: Familiarity with **Machine Learning** and **Deep Learning**

RELATED MATERIAL:

- Numan, Mostafa W., et al. "Towards automatic high-level code deployment on reconfigurable platforms: A survey of high-level synthesis tools and toolchains." *IEEE Access* 8 (2020): 174692-174722.
- Xydis, Sotirios, Eleftherios Christoforidis, and Dimitrios Soudris. "DDOT: Data Driven Online Tuning for energy efficient acceleration." *2020 57th ACM/IEEE Design Automation Conference (DAC)*. IEEE, 2020.

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