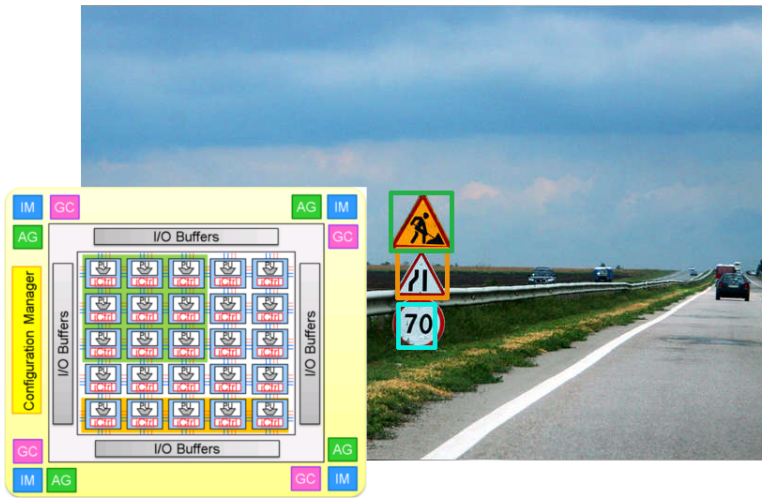
Approximate computing through anytime-instructions

In systems with limited energy capacities, it is crucial to monitor and control the workload and energy consumption. For example, in autonomous driving, the vehicles have to juggle calculations and controlling motor functions. But not all applications need a concrete result to continue on or make decisions. Such vehicles may use image based object detection to trace the road or recognize traffic signs. There, slight variations in single pixels barely matter. Usually, such detection mechanisms work with image filters, containing a lot of additions and multiplications. With approximate computing, a trade-off can be achieved between the accuracy and the latency of such operations. Therefore it is possible to improve the runtime behavior, but still produce acceptable results for specific applications.



The goal of this work is the development and analysis of anytime-addition and anytime-multiplication instructions for use inside a loop accelerator. This accelerator consists of an array of tightly coupled processors. Anytime-instructions are instructions, that can be halted after an arbitrary number of cycles, thus producing an inaccurate, but in the best case valid result. To achieve this, the concept of online-arithmetics shall be used. In online-arithmetics, the operations are transformed such that usual least-significant-digit-first operations (e.g., addition) can be calculated most-significant-digit-first through the use of redundant number representations.

Voraussetzungen:	Programmierkenntnisse in VHDL
Art der Arbeit:	Theorie (30%), Konzeption (40%), Implementierung (30%)
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