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Exploration of Approximate Memory Architectures for HEVC

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1 Introduction

The advance in video coding techniques is object of intense research. The need to provide efficient video coding for the increasing resolutions led to the introduction of the HEVC (High Efficiency Video Coding, or H.265) standard by ISO&ITU in 2013. The techniques employed by HEVC use data structures that are more complex and demand more computational effort in comparison to its predecessor, H.264/AVC. The previous studies conducted targeting the cache memory hierarchy [1] support further investigation related to memories, specially related to the modules that perform the most memory accesses. HEVC runs in platforms with complex memory hierarchies, and because of the great impact both in execution time and energy consumption associated to memory accesses, improving the memory architecture, video coding and memory configurations can bring interesting trade-offs in execution time, coding efficiency and overall energy consumption.

2 Methodology and Partial Results

The papers [2] and [3] propose schemes where the programmer can select the data that is allocated in approximate memory, a strategy that we intend to test and improve for HEVC. The encoding process is very resilient to faults, e.g. the different algorithms applied will probably mask faulty bits if the data differs too much from the average in a given Coding Tree Unit (CTU). In this context, it's interesting to note that higher resolution videos are more resilient because the CTUs have less variation in the pixel values, and therefore compromised bits are more likely to be dismissed. Tests with a 144p video with the fault injection software CAROL-FI have shown a Silent Data Corruption (SDC) rate of 0,45% while 99.5% were masked during the process (5.000 injections). Testing higher video resolutions (240p and 480p) for 10.000 injections resulted in no SDCs. These results indicate that shifting to a more specialized focus for the tests is necessary in order to identify significant modules of the video coding that are resilient where approximate memories could be used, and isolate the areas that are more critical and should use exact memories.

References

[1] A. Mativi, E. Monteiro, and S. Bampi. Memory Access Profiling for HEVC Encoders. In *2016 IEEE 7th Latin American Symposium on Circuits Systems (LASCAS)*, pages 243–246, 2016.

[2] G. Stazi, F. Menichelli, A. Mastrandrea, and M. Olivieri. Introducing Approximate Memory Support in Linux Kernel. In *2017 13th Conference on Ph.D. Research in Microelectronics and Electronics (PRIME)*, pages 97–100, 2017.

[3] A. Ranjan, A. Raha, V. Raghunathan, and A. Raghunathan. Approximate Memory Compression for Energy-Efficiency. In *2017 IEEE/ACM International Symposium on Low Power Electronics and Design (ISLPED)*, pages 1–6, 2017.