Masters-Thesis/Diplomarbeit/Studienarbeit

Hybrid Memory Architecture for Next-Generation High Efficiency Video Coding

One of the most central system design decision is about memory allotment, its energy consumption and usage. The emerging Non-Volatile Memory (NVM) technology can be regarded as a solution to high memory leakage power of current cache and external memories, however, it presents a challenge to the system designer where the designer must consider the structure and read/write overhead of NVMs while following a hybrid-memory approach (involving on-chip and off-chip SRAMs, MRAMs, PCRAMs and DRAMs). Alternatively, application specific memory architecture development can result in high performance and energy gains.

High Efficiency Video Coding (HEVC/H.265) is a predecessor of the current industry standard for video compression, H.264. It strives to provide an additional 50% compression efficiency, as compared to H.264. However, this compression efficiency is accompanied by huge complexity overhead.

In this work, we will design an HEVC system which will utilize the hybrid memory approach in order to reduce the energy overhead and decrease the time-penalties by exploiting memory access patterns and video content properties, at the HEVC encoder/decoder. Specifically, the Motion Estimation (ME) at both HEVC encoder and decoder will be considered which is the most time and energy consuming process for video compression.

We will implement the system simulation for hybrid cache and external memories via the "gem5" simulator (built upon either ARM or x86, single or multiple cores) and will import the HEVC binaries. Different configurations of memories will be tested and the reported results will be used for further optimization. However, additional or separate tasks are also welcome and can be discussed. Please don’t hesitate to fix an appointment.

Required Skills
- Good hands-on skills for C++
- Knowledge of video coding NOT required

Additional Skills
- Knowledge of Python and MATLAB is a plus

Acquired Skills
- Knowledge of system and memory Simulations, video compression (HEVC), multicore architectures, MATLAB

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