Universidade de Aveiro

Mestrado Integrado em Engenharia de Computadores e Telemática
Arquitecturas de Alto Desempenho

Assignment 2 – Cyclic Cross Correlation

Academic year 2023/2024
Problem idea: Tomás Oliveira e Silva

UNDERLYING CONCEPT

Circular cross-correlation is an important tool to detect similarities between a pair of signals. Let $x(k)$ and $y(k)$, with $0 \leq k < N$, be two discrete signals, then the *circular cross-correlation rxy(τ)* is defined by the formula

$$rxy(\tau) = \sum_{k=0}^{n-1} x(k) \cdot y[(\tau+k) \bmod n] \ .$$

A fully functional reference implementation of the operation is provided to you in the source file `cyclicCircConv.cu`, where the computation kernel is both run solely in the CPU and together in the CPU and the GPU, as an example of heterogeneous computing. Their execution times are listed for comparation.

In the latter case, the thread launch grid is not optimized on purpose.

ASSIGNMENT

Your task is to optimize the thread launch grid and draw conclusions about the usefulness of offloading the computation to a GPU device.

The assignment entails that some investigation on the factors that limit GPU performance. The presentation must illustrate how these factors affect the performance in this specific case, so plots of execution times, and explanations of their variation, for meaningful thread launch grids should be provided.

GRADING

- thread launch grid optimization as well as plots of execution times and explanations of their variation for meaningful thread launch grids by using the reference implementation `cyclicCircConvDouble.cu` – 13 valores
- explanations of how different factors affect GPU performance and conclusions about how efficient is to offload the computation to a GPU – 17 valores.

DELIVERABLE

- an archive, named `CCC_T$G#.zip` (where $, equal to 1, … , 3, means the lab number and #, equal to 1, …, 8, means the group number), containing the optimized code and a pdf file, up to 4 power point like pages, named *presentation*, where the main ideas are described.

DEADLINE

- January 2 2024, at midnight.