UNIVERSITÀ DEGLI STUDI DI TORINO

ID

VP120_DIP_INF

Visiting Professor Program
Academic year 2022/2023

TEACHING COMMITMENT: 24 hours

COURSE TITLE

Energy-efficient neural architectures for image analysis and video coding.

TEACHING PERIOD
2nd term

SCIENTIFIC AREA
Computer science

LANGUAGE USED TO TEACH
English

COURSE SUMMARY
Over the past years, the deep learning paradigm has enjoyed increasing successes in fields related to image analysis and video coding. Such achievements come however at the price of increased memory requirements and computational complexity with respect to traditional algorithms. This is especially an issue in user devices such as mobiles, where the resources are limited. In cloud environments, these requirements translate into increased energy consumption. So, for the deep learning paradigm to be profitably applicable to image analysis and video coding, resource- and energy-efficient implementations are required. Hardware implementations over FPGAs or ASICSs have recently shown to be able to reduce the energy consumption of these algorithms to a point where they become practical. This course aims at providing the foundations on the methods and tools enabling to implement energy efficient neural network based algorithms for image analysis and video coding tasks.

LEARNING OBJECTIVES
At the end of the course the student should be able to analyze neural network based image processing algorithms, identify the main sources of memory and computational complexity of an

algorithm, define throughput requirements, suggest hardware-oriented optimizations and propose energy-efficient hardware architectures including processing units and memory hierarchies.

TUTORSHIP ACTIVITIES
N/A

LAB ACTIVITIES
It is desirable that the course includes at least one of the following practical activities

Processing units design: Register-Transfer Level (e.g, using VHDL/Verilog targeting FPGA)

Processing units design: High-Level Synthesis (e.g, using Intel HLS or Xilinx Vivado, depending on the platform available)

Memory hierarchy modeling and design (e.g., using CACTI and NVSIM)

Energy/Power analysis (e.g., using Intel Quartus Prime or Vivado power analyzer)

OTHER ACTIVITIES BESIDES THE COURSE
It is desirable that the visiting professor organizes at least one seminar addressed to the PhD students of the conferences and participates to teh research activities of the host group.

VISITING PROFESSOR PROFILE
The sought profile shall have a strong background in energy-efficient implementations of algorithms for image analysis over FPGAs and ASICs. The sought profile shall also include proven hands-on experience with standardized coding technologies such as, for example, H.264, MVC, SVC, HEVC, 3D-HEVC, VVC, AV1. It is also very desirable that the profile includes skills in techniques for efficient deep learning for video prediction.

CONTACT PERSON AT THE DEPARTMENT
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