UNIVERSITY OF MACAU
FACULTY OF SCIENCE AND TECHNOLOGY

Distinguished Lecture

GPU COMPUTING FOR SPEEDING UP HIGH DEMANDING SIGNAL PROCESSING APPLICATIONS

Date and Time: 10th May 2012 (Thursday), 11:00 AM
Venue: HG03, Ho Yin Convention Center, University of Macau

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Abstract: For more than a decade Graphics Processing Units (GPUs) have become a natural extension of conventional computers. The advent of new programming models and languages made them ubiquitous multicore computing machines that allow exploiting massive levels of parallelism. In order to conveniently develop parallel programs, adequate techniques have to be considered in order to minimize the bottleneck caused by communications. These techniques are: a proper use of the memory hierarchy of the system, minimization of data transfers between host and device, the use of coalesced memory accesses, masking communications with computation, data representation, etc. When properly addressed, these strategies allow achieving performances orders of magnitude above those obtained with conventional CPUs. We investigate the use of GPUs in two signal processing case-studies that include: 1) Monte Carlo simulations for the development of Low-Density Parity-Check codes and corresponding performance analysis of BER curves as a function of channel SNR variable conditions, which for new optical communication standards can take months to complete; and 2) real-time correction of radial distortion in endoscopic medical images captured during laparoscopic surgery or diagnosis exams, where HD image resolutions and high frame rates have necessarily to be supported and make the challenge even harder. The different nature of both cases seem to cover a vast set of application scenarios in the area of signal processing and we address the most common challenges faced and how they can be successfully overcome. We show that for both case-studies, throughput performance largely surpasses real-time requirements.

Gabriel Falcão graduated at the University of Porto, Portugal, where he also concluded a MSc. degree in the area of digital signal processing. In 2010 he received a Ph.D. in Electrical and Computer Engineering from the Faculty of Science and Technology of the University of Coimbra, Portugal, where he is currently an Assistant Professor. In 2011 he became a Visiting Professor at EPFL, in Switzerland. He is also a researcher at the Instituto de Telecomunicações and his scientific interests include ECC, high-performance and parallel computing, hybrid computation on heterogeneous systems, hardware accelerators and digital signal processing algorithms, namely those related with medical imaging, an area in which he holds a patent. Gabriel is a Member of the IEEE and IEEE Signal Processing Society.

The lectures are open to the public

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