

Department of Electrical and Computer Engineering

Title: *"An Exploration of Stereo Vision Hardware Architectures for 3D Depth Perception in Embedded Vision Applications"*

Christos Ttofi, PhD Student
Department of Electrical and Computer Engineering, University of Cyprus

Wednesday, 9th April 2014, 17:30 – 18:30
Room KENTP. - A008, Old Campus
University of Cyprus

Abstract:

Empowering vision systems with 3D perception capabilities is expected to lead to a boost of new applications that so far could not be done with classical 2D alternatives. Applications of this new trend already exist in numerous areas: from consumer electronics and entertainment, to robotics, automotives, medical imaging, defense, etc. Stereoscopic vision is a well-suited technology that uses two standard image cameras to infer depth information, by solving the so-called stereo matching problem. This involves searching and locating corresponding projections of the same 3D points sensed by the two cameras in different positions, a challenging task that can be tackled with many algorithms, consequently producing different outcomes in terms of accuracy and computational complexity. Stereo matching becomes even more challenging when targeting applications in embedded and mobile environments, where cost, energy and memory overheads need to be minimized.

This presentation will investigate hardware architectures of stereo matching algorithms that have the potential to satisfy the requirements of constrained embedded vision applications. Initially, a stereo matching architecture that utilizes edge information as a means to accelerate the overall matching process, and reduce its logic and memory requirements, will be presented. Afterwards, the presentation will introduce hardware design optimizations that can be applied to a complex, accurate matching algorithm that uses adaptive support weights (ADSW), in order to obtain an effective speed-accuracy tradeoff. Moreover, the presentation will discuss how the properties of the recently proposed Guided Image Filter, and particularly its edge-preserving property and linear-time complexity, can be exploited to reduce the hardware complexity of the ADSW matching process, while maintaining high quality results. Finally, the presentation will provide insights obtained from evaluating the proposed architectures in object detection and obstacle avoidance applications.

Biography:

Christos Ttofi received the Bachelor's Degree and Master's Degree in Computer Engineering from the University of Cyprus in 2009 and 2011, respectively. Since 2011, he is working toward the PhD degree in Computer Engineering at the University of Cyprus. He is a researcher at the Embedded and Application Specific System-on-Chip Laboratory (EASoC) at the KIOS Research Center. His research interests include Embedded Systems Design, Image Processing and Computer Vision, Field Programmable Gate Arrays (FPGAs), Computer Arithmetic and Computer Architecture. Christos has been involved in various projects funded by the European Commission and the Research Promotion Foundation of Cyprus. He is also a student Member of the IEEE and the IEEE Computer Society, and a member of the Technical Chamber of Cyprus (ETEK).