Master thesis : NVIDIA Jetson Xavier AGX as multimedia broadcast system

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Abstract

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NVIDIA Jetson Xavier AGX as multimedia broadcast system

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On the one hand, with the emergence, in particular, of the Internet of Things (IoT) and artificial intelligence, embedded systems are becoming increasingly popular and are used in many applications, including autonomous machines. The use of autonomous machines has revolutionized the industry, with inventions, such as repetitive task robots used in manufacturing and medical sensors in healthcare. Indeed, to name but two advantages, autonomous machines allow for cost efficiency and quality assurance.
On the other hand, the audiovisual world is becoming increasingly demanding, particularly in terms of image quality. Indeed, while 4K resolution is becoming the quality standard, researchers are already setting up increasingly complex systems to broadcast 8K content on a large scale. This implies a furious growth in the amount of data transferred, given the growth in image quality and the numerous users enjoying video content every single day.
However, the internet network responsible for data transfer is a very limited resource unable to support more and more data without problems. Video streaming is governed by a trade-off between video quality, computation, and compression rate. To succeed in providing ever higher image quality, video content must, therefore, be both compressed at never before achieved compression rates thanks to increasingly complex video encoding standards, and processed by increasingly powerful machines.

The hardware, which is at the center of this work, was the NVIDIA Jetson Xavier AGX developer kit. This developer kit allows to build and produce software solutions on a large scale in Jetson Xavier AGX modules, often used in autonomous machines. Therefore, the purpose of this thesis was to provide a broadcasting solution as powerful and portable as possible on an NVIDIA Jetson Xavier AGX module.

This thesis addresses the issue of video streaming by analyzing the different main video formats, video coding standards, and key video compression techniques. Then, this project deals mainly with the computational part of the trade-off, *i.e.*, providing more computing power to accelerate the decompression of encoded data on embedded systems, via well-known and advanced formats such as H.264 or H.265. For the practical part of this thesis, we will first analyze the decoding performance of a solution based on the specific hardware of the AGX module. Then, we will extend this powerful solution to make it as portable as possible by using CPU and then GPU programming. Finally, we will compare the results provided by the different solutions.