Effective Object Detection Neural Network on an Autonomous Robotics Platform Applied on TPU and Other Systems

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Nowadays, the balance between speed and accuracy in object detection neural networks is an ongoing issue with a lot of active research. Some architectures are dealing with it specifically but are created for complex datasets such as COCO or ImageNet and therefore are not as efficient for simpler and smaller ones. Creating a RoboCup robot, I came across this, and as I developed some original solutions, I wanted to make them applicable to other projects. I started my work with different combinations of hardware and existing architectures such as EfficientNet, YOLOv3, MobileNets, etc. The results, however, were unsatisfactory, making me create my own architecture based on the best performing one, which I combined with TPU as it was best for neural network acceleration. I tested it on my own dataset, tried different argumentation methods, and created other crucial software and hardware. The result was a real-time object detector applied on TPU, tested on an autonomous robot, combined with other systems, like detection of field lines, ball-handling, or driving systems. I then made camera hardware, capable of running Ubuntu 20.04 with the power of 4 TOPS and size of 55x40 mm, usable in many fields. In conclusion, using an unusual approach, I created an efficient object detection neural network successfully used on my robot and a small camera. My work is open source and is already helping scientists. In the future, I want to make the camera commercially available with the hope of contributing to more effective technological solutions.

Awards Won:

Second Award of $2,000