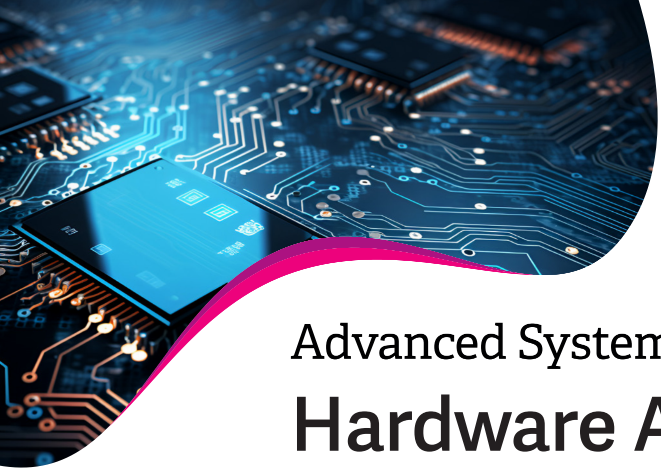
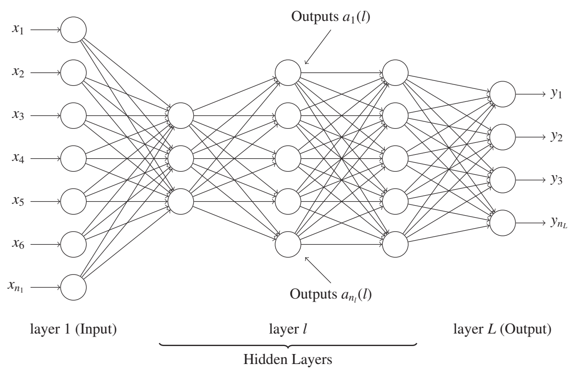


OST
Eastern Switzerland
University of Applied Sciences

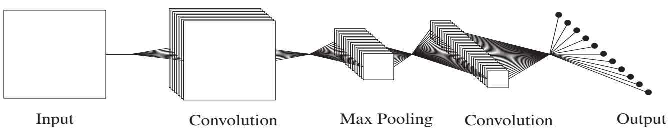
Advanced System Technologies

Hardware Accelerated Human Pose Estimation

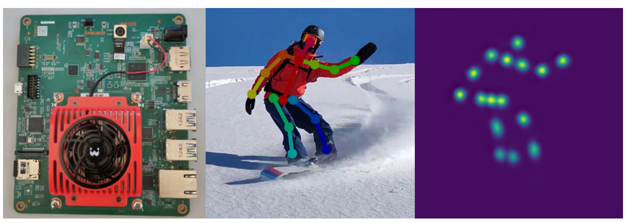
Human Pose Estimation (HPE) recognises a kinematic model of the human body from image data. The Interdisciplinary Centre for Artificial Intelligence (ICAI) at the OST has further developed the well-known HPE network OpenPose and made it computationally more efficient. Employees of the IMES Institute for Microelectronics, Embedded Systems and Sensor Technology have accelerated ICAIPose on FPGA hardware.



FullyConnected Layers



Convolutional and Pooling Layers



ICAIPose on the Kira KV260 Board

Objective

IMES employees have successfully implemented the ICAIPose project on the Kria KV 260 Edge FPGA from AMD-Xilinx. By transferring ICAIPose from conventional graphics cards to an FPGA, the effort required to operate the network was minimised without compromising performance. IMES not only demonstrated the technical feasibility of this project, but also identified the potential financial and practical benefits of an FPGA-based solution compared to conventional GPU-based approaches.

Procedure

A camera interface with a deep learning processing unit was successfully integrated for the project. Vitis AI from AMD-Xilinx was used to compile the network for the deep learning processing unit (DPU) on the FPGA. The Python API, which is part of the package, enabled smooth communication with the DPU via an embedded Linux on the FPGA's microprocessor. Extensive testing and optimisation was carried out to achieve the best possible performance and efficiency.

Conclusion

ICAIPose is an extremely complex neural network that requires more than 100 billion operations to process a single image. Despite these enormous requirements, the Kria KV260 achieves an impressive frame rate of 8 frames per second. This fact emphasises the FPGA solution and the performance of the Kria KV260. In comparison, the GPU-based NVIDIA Jetson Xavier NX, which costs more than twice as much as the Kria board, achieves a similar frame rate. The successful implementation of ICAIPose on the Kria KV260 demonstrates the enormous potential of FPGA technology for complex deep learning applications and thus opens up new possibilities for future developments in this field. area.

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