# Achieving Faster AI-based Medical Diagnosis Support with AMD Alveo™ Accelerator Cards

## AMD Alveo U250 Accelerators Adopted by Hiroshima University for Faster Image-based Cancer Diagnosis Support Solution Featuring Machine Learning Inference

### AT A GLANCE:

Since it was first established as a ministerially designated research center under the Ministry of Education, Culture, Sports, Science and Technology, the Research Institute for Nanodevice and Bio Systems at Hiroshima University has been striving to bring advanced healthcare to the public by engaging in the development of key technologies that combine electronics and biotechnology for preventive medicine and the ubiquitous early diagnosis of illness. By establishing techniques that use machine learning to quantify the possible presence and invasiveness of tumors, the institute is helping to reduce the burden of medical practitioners at the forefront of oncology.

**Customer:** Research Institute for Nanodevice and Bio Systems, Hiroshima University
**Established:** 1986
**Industry:** Healthcare/Medical
http://www.RNBS.hiroshima-u.ac.jp/

### CHALLENGE:

The task of diagnosing whether an abnormality identified during a colonoscopy is a hyperplastic polyp, a benign adenoma, or an invasive cancer depends upon the experience and expertise of the physician. The judgement is made based on the pattern of blood vessels and surface features visible in the colonoscopy images. This means there is an urgent need for diagnostic support systems that can make this task easier for the physician by providing quantitative indicators, thereby reducing the variability of diagnostic results due to different levels of experience. Moreover, this image-based diagnosis is made during the colonoscopy and there is only so much that can be achieved in terms of real-time performance when using conventional software-based techniques only.

Associate Professor Tetsushi Koide of the Research Institute for Nanodevice and Bio Systems at Hiroshima University commented that, “To determine whether or not a cancer is present, the physician needs to use the colonoscope to observe the surface features and pattern of blood vessels in a lesion in real time to identify whether it is a tumor, and if so to assess its invasiveness. Physicians talk about making these judgements on the basis of the overall available evidence, including parameters such as irregularities in small blood

vessels and surface features. Accordingly, the results are influenced by their level of experience and what cases they have been exposed to in the past. This can make objective judgement difficult in the case of physicians who are new to endoscopy and lack experience." In other words, while the final cancer diagnosis is made by the expert physician, a degree of variability inevitably arises due to the fact that this is done by a human being looking at the endoscope images.

## SOLUTION:

Provided a system that assists the physician to make a diagnosis by using AI (machine learning) to quantify the progress of a lesion based on colonoscopy image data. The system uses AMD Alveo U250 accelerator cards to improve real-time processing speed. Miniaturization and optimization of the system is achieved by implementation on a AMD Zynq™ UltraScale+™ MPSoC using an architecture that combines embedded software and hardware logic, thereby enabling its use as an edge device.


Figure 1: Alveo U250 UltraScale+ MPSoC


Figure : Zynq UltraScale+ MPSoC

**Features of computer-aided diagnosis system using the Alveo U250 accelerator card**

Features of computer-aided diagnosis system using the Alveo U250 accelerator card

- High-speed AI achieved using AlexNet IP on quantization Caffe model
- SVM implementation on Alveo accelerator card is complete and ready for demo execution
- Scope for utilizing the technology in an edge-based solution made possible by using the server CPU and Alveo accelerator card configuration on the MPSoC device.

The AMD Vitis™ Unified Software Platform was used for software development. Using the domain-specific development environment provided by the Vitis platform, the programming for the FPGA was completed in only three months.

## RESULTS:

Data that has previously undergone learning is incorporated into a convolutional neural network (CNN) and used as a basis for assessing the video input from the endoscope in real time.

CNN performance is a key issue when using this CNN and a support vector machine (SVM) to perform inference. Operation of the CNN involves dividing each frame from the 30fps of Full High Definition (FHD, 1,920 x 1,080 dots) video into, for example, 16 regions to resize it (224x224 pixel ) for input to the inference engine. As each inference operation requires the processing of approximately 1.89GB/s of data, the simultaneous evaluation of 16 regions calls for 1.89GB/s x 16 ≈ 30GB/s of processing capacity. This exceeds the performance capabilities of conventional CPUs (such as x86 or ARM processors).

By instead using a AMD Alveo U250 accelerator to process this data, the institute succeeded in building a system with more than enough processing performance to perform CNN/SVM inference on any 16 regions of the video images in real time. In practice, this simultaneous evaluation of 16 regions is achieved by four processing units with Alveo U250 cards executing in parallel.

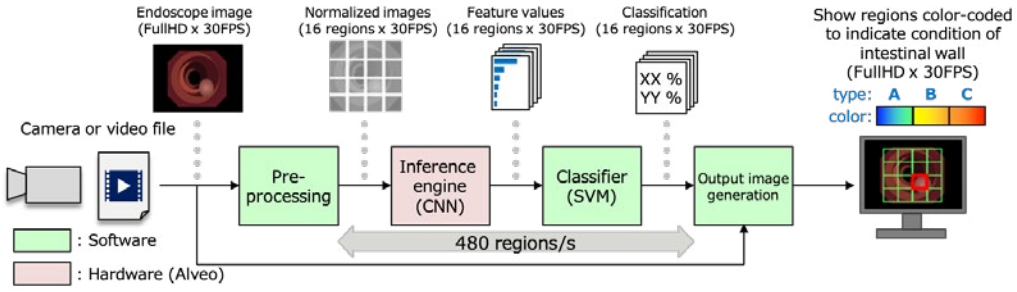


Figure 3: Real-time processing with the Alveo U250 card

“This study was conducted in collaboration with Hiroshima University Hospital and JR Hiroshima Hospital. Use of AMD Alveo cards has advanced our research into increasing the speed of systems for the diagnostic support of medical imaging by enabling AI-based image evaluation at speeds that could not be achieved by the conventional CPUs used to date,” said Associate Professor Tetsushi Koide of the Research Institute for Nanodevice and Bio Systems.


PID 1870060