SOLUTION BRIEF

Healthcare
Medical Imaging with AI

KFBIO Accelerates Cancer Detection Workloads with Intel® AI Technology

INTEL® AI BUILDERS MEMBER

KFBIO technology for health.

Up to 8.4X[1] faster inferencing using Intel Xeon® Scalable processors and Intel Distribution of OpenVINO™ Toolkit

Cervical cancer is the fourth most frequent cancer in women with an estimated 570,000 new cases in 2018 representing 6.6% of all female cancers.[2] Early diagnosis through Papanicolaou (Pap) screening along with treatment significantly improve the chances of patient survival. Introduced in the 1990s, the liquid-based cytology (LBC) method for cervical cancer screening is currently used by over 90 percent of the Pap tests performed in the United States, according to the National Institutes of Health (NIH).[3] In China, approximately 60 million new test specimens are gathered every year.[4] Such a large volume of tests needing analysis makes it difficult for doctors to manually screen and diagnose them in a timely manner using a traditional approach.

LBC-based Pap smears can be scanned using automated, digital scanning systems to detect the presence of precancerous and cancerous cells. With the advancement in deep learning (DL) technologies and availability of powerful computing systems, AI-based screening solutions become both practical and necessary in solving the challenges of diagnosing LBC-based Pap tests.

Deep Learning-Based Screening Assists Diagnosis of Cervical Cancer

Ningbo Konfoong Bioinformation Tech Co., Ltd (KFBIO) is a total solution provider of pathology related products which include sample processing equipment, digital pathology scanning systems, pathology information system and DL algorithms/models for detecting and classifying precancerous changes and abnormalities. Building upon its core strength as a leading medical pathology slide scanner manufacturer in China (thousands of devices deployed in various hospitals), KFBIO's capability in scanning traditional pathological sections into digital images allows scientists to apply DL techniques to assist medical diagnosis. KFBIO has developed a suite of AI-powered pathological solutions based on DL technology, including cervical cancer detection in Pap test results using LBC (KFLBPS), circulating tumor cell detection, M. tuberculosis detection (KFTBS), and others. Both KFLBPS and KFTBS have already obtained CFDA certificate, and KFLBPS is ready to provide cervical cancer screening service for over 400 million women in China.

Digital imaging makes it possible for medical data to be stored, shared, and analyzed collaboratively over a network. Digital pathology with AI helps address the shortages in medical resources and provides better accessibility to diagnosis for people in remote and rural areas.

The performance demonstrated in this paper underscores the potential of AI-based cervical cancer screening through collaboration between KFBIO and Intel. Through collaboration with leading hospitals, KFBIO is able to gain access to more Pap test data to refine the model and improve the algorithm.

Intel AI Technologies Accelerate Automated Screening 8.4X[1]

While KFBIO had an effective DL solution for scanning LBC-based cervical cancer specimens, their engineers wanted higher performance in order to complete scanning faster. Collaborating with Intel engineers, KFBIO integrated the Intel Optimization for TensorFlow and Intel Distribution of OpenVINO™ Toolkit into their DL software stack. The optimizations improved inference performance by 8.4X[1] for workloads running on Intel Xeon Gold 6148 processors, compared to a baseline model throughput on the same processors without optimizations (see figure 1).

The Intel Distribution of OpenVINO toolkit offers resources for developers to create applications and solutions that emulate human vision, optimize deep learning solutions across multiple Intel platforms—CPU, GPU, FPGA, and VPU—and accelerate deep neural network workloads. Based on convolutional neural networks (CNN), the toolkit:

- Enables deep learning inference at the edge
- Supports heterogeneous execution across computer vision accelerators—CPU, GPU, Intel Movidius™ Neural Compute Stick, and FPGA—using a common API
- Speeds up time to market via a library of functions and pre-optimized kernels
- Includes optimized calls for OpenCV and OpenVX

The Intel Optimization for TensorFlow provides optimized libraries for models built on the TensorFlow framework to take advantage of Intel processor capabilities that will help accelerate training and inferencing times. To fully utilize the power of Intel architecture (IA) for high performance, the Intel Optimization for TensorFlow includes the Intel Data Analytics Acceleration Library (Intel DAAL), a library of highly optimized math routines for deep learning tasks that includes convolution, normalization, activation, inner product, and other primitives. With Intel Optimization for TensorFlow, developers can achieve accelerated execution with no code changes.

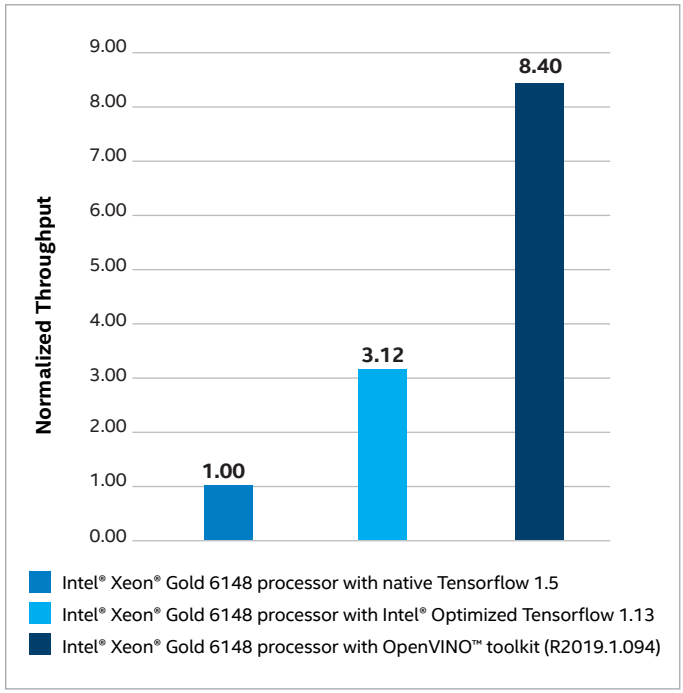

Figure 1.

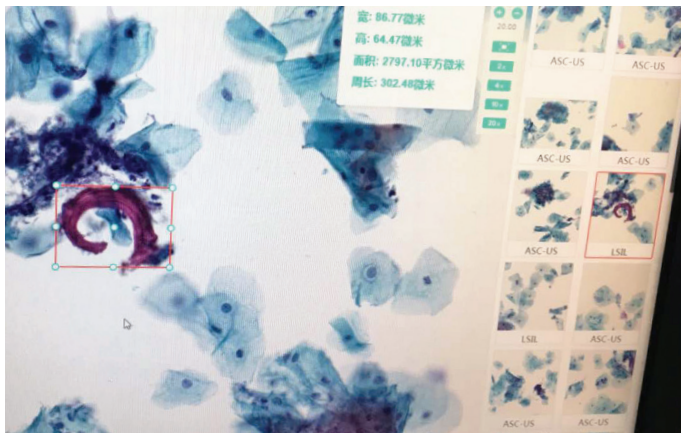

Figure 2. KFBIO's AI-based cancer screening solution detects cell anomalies 8.4X faster[1] with Intel AI technologies, helping to speed cervical cancer diagnoses.

Conclusion

The LBC method for cervical cancer specimen screening is widely used for early detection of this fourth leading cancer in women. Accelerating machine screening of specimens using AI technologies can increase the number of specimens screened and potentially alert physicians to patient concerns more quickly. Using Intel Optimization for TensorFlow and Intel Distribution of OpenVINO toolkit KFBIO increased inference performance of cervical cancer screening by up to 8.4X[1] on Intel Xeon Gold 6148 processors, compared to non-optimized models. Digital pathology images are large, most commonly up to 40K x 40K, and therefore require large amounts of system memory for AI processing. CPU based systems can offer several hundred gigabytes of memory making it the ideal choice for digital pathology workloads.

About KFBIO

Konfoong Biotech International Co., Ltd. is a high-tech biological information technology enterprise specializing in digital pathology system development and production. Their integrated digital pathology diagnosis system provides an ultimate solution platform, integrating health care, education, scientific research and information services. For more information about KFBIO, visit http://en.kfbio.cn/

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Links to Intel DAAL and OpenVINO and xeon:

https://software.intel.com/en-us/articles/what-is-intel-daal

https://software.intel.com/en-us/openvino-toolkit

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1. KFBIO Cervical Cancer Screening OpenVINO Model Throughput Performance on Intel® Xeon® Gold 6148 Processor:

   NEW:
   Test 1: Tested by Intel as of 6/15/2019. 2 socket Intel® Xeon® Gold 6148 Processor, 20 cores HT On Turbo ON Total Memory 192 GB (12 slots/ 16GB/ 2666 MHz), BIOS: SE5C620.86B.0X.01.0007.062120172125 (ucode: 0x200004d), CentOS Linux release 7.5.1804 (Core), Deep Learning Framework: Keras 2.2.4 and Intel Optimized TensorFlow: 1.13.1, Topology: RetinaNet: https://github.com/fizyr/keras-retinanet, Compiler: gcc 4.8.5,MKL DNN version: v0.17, BS=8, both Synthetic data and customer data, 1 instance/2 socket, Datatype: FP32

   Test 2: Tested by Intel as of 6/15/2019. 2 socket Intel® Xeon® Gold 6148 Processor, 20 cores HT On Turbo ON Total Memory 192 GB (12 slots/ 16GB/ 2666 MHz), BIOS: SE5C620.86B.0X.01.0007.062120172125 (ucode: 0x200004d), CentOS Linux release 7.5.1804 (Core), Intel Software: OpenVINO R2019.1.1094, Topology: RetinaNet: https://github.com/fizyr/keras-retinanet, Compiler: gcc 4.8.5,MKL DNN version: v0.17, BS=1, 8 Asynchronous Requests, both Synthetic data and customer data, 1 instance/2 socket , Datatype: FP32

   BASELINE:
   Tested by Intel as of 6/15/2019. 2 socket Intel® Xeon® Gold 6148 Processor, 20 cores HT On Turbo ON Total Memory 192 GB (12 slots/ 16GB/ 2666 MHz), BIOS: SE5C620.86B.0X.01.0007.062120172125 (ucode: 0x200004d), CentOS Linux release 7.5.1804 (Core), Deep Learning Framework: Keras 2.2.4 and Vanilla Tensorflow: 1.5, Topology: RetinaNet: https://github.com/fizyr/keras-retinanet, Compiler: gcc 4.8.5,MKL DNN version: v0.17, BS=8, both Synthetic data and customer data, 1 instance/2 socket, Datatype: FP32

2. https://www.who.int/cancer/prevention/diagnosis-screening/cervical-cancer/en/

3. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3101959/

4. http://www.kingmed.com.cn/web/media_x/p_media_x.html?ID=2706

Performance results are based on testing as of dates shown in configuration and may not reflect all publicly available security updates. No product can be absolutely secure. See configuration disclosure for details.

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