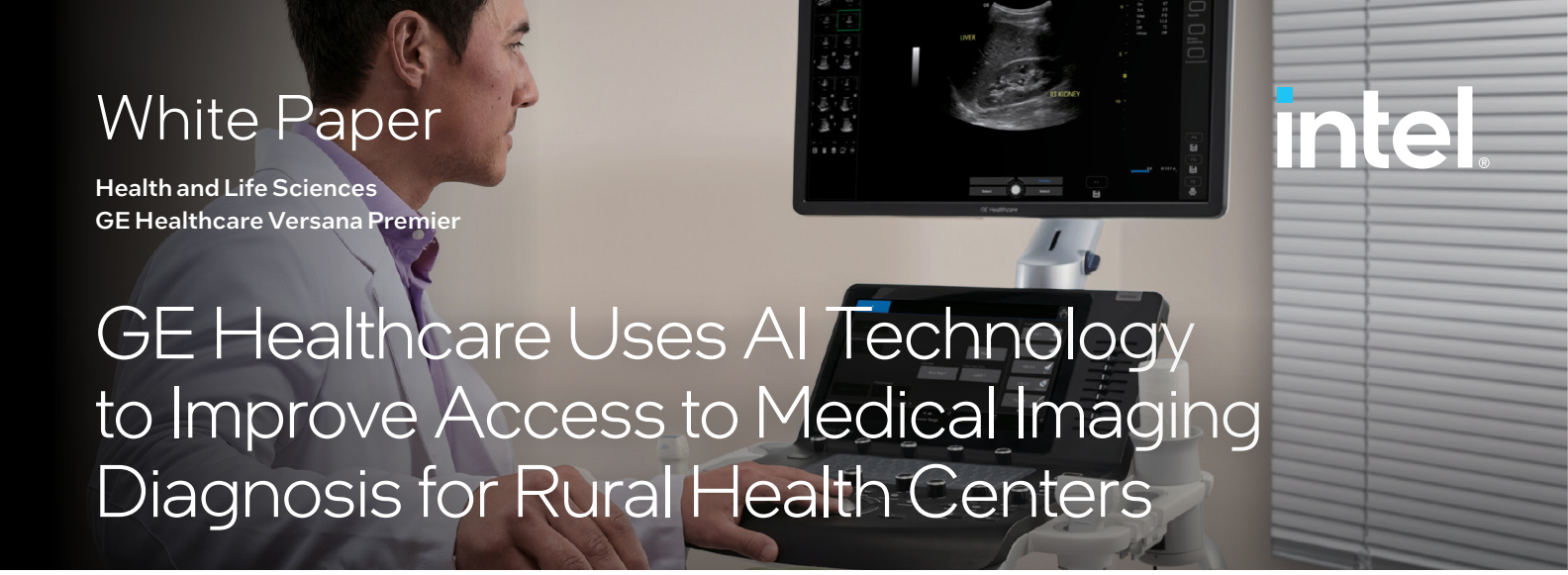

White Paper

Health and Life Sciences
GE Healthcare Versana Premier

GE Healthcare Uses AI Technology to Improve Access to Medical Imaging Diagnosis for Rural Health Centers

GE Healthcare

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OpenVINO™

Ultrasound devices have proven their value in a variety of clinical applications, including radiology, cardiology, and obstetrics and gynecology. Ultrasound technology enables rapid diagnosis and gives doctors critical information to support their subsequent treatment plans. However, healthcare facilities outside of large population centers often experience shortages in personnel, training, and diagnostic capacities. A new class of ultrasound equipment that includes artificial intelligence (AI)–based image features has the potential to help compensate for these challenges.

Against this backdrop, GE Healthcare has launched Versana Premier, the premium ultrasound system from the Versana family. Versana Premier brings quality, reliability, portability, and ease of use to a versatile ultrasound device.

The Versana Premier ultrasound system uses AI to provide several automated near-real-time image enhancement features. What's more, it is able to automatically label the human tissues in an image with a method based on deep learning neural network technology.

GE Healthcare uses the Intel® Distribution of OpenVINO™ toolkit to optimize the inference performance of AI models running on the embedded processors within the Versana Premier system. These advances make it much easier for personnel without advanced training to use the equipment, helping to broaden access to high-quality medical resources in less-developed areas.

Background: Rural healthcare facilities need highly automated and easy-to-use ultrasound equipment

Ultrasound testing techniques are used by healthcare providers to make diagnostic decisions based on seeing or measuring the patient's anatomical structure. The ultrasound equipment market has witnessed a rapid growth because of the technology's advantages of being noninvasive, nonintrusive, repeatable, and adaptable. The equipment is also one of the most affordable forms of medical imaging technology. According to Fortune Business Insights, the global ultrasound equipment market size stood at USD 7.77 billion in 2019 and is projected to reach USD 12.9 billion by the end of 2027, representing a CAGR of 7.4 percent.[1]

Unfortunately, there is a disparity in access to ultrasound diagnosis equipment. Large and medium-sized medical institutions in urban regions typically have more resources in terms of capital, healthcare services, and business scale. Especially when compared to medical institutions in less-developed areas, the demands for both the number of ultrasound devices and ultrasound diagnosis capabilities are often unmet. Without enough advanced ultrasound devices and well-trained radiologists, the potential of ultrasound equipment fails to be fully leveraged, with commonly seen problems like undertrained personnel and high diagnostic error rates.

New AI technologies can be used to address these challenges and improve the intelligence, automation, and ease of use of ultrasound equipment as well as lower the threshold for its correct use, thereby reducing the level of training needed.

However, as the AI workloads running in ultrasound devices become more complex, the demands for increased AI computing power are growing in tandem. One option to increase computing power is to add powerful hardware accelerators to the system, but an investment in accelerators may be costly because of the increased power consumption, size, cost, heat dissipation, and power supplies such a solution would require. As ultrasound equipment development is trending toward portability for ease of use, ultrasound equipment providers would prefer to optimize the equipment's AI performance based on lighter-weight requirements.

Solution: Optimize and accelerate AI algorithm deployment with the Intel Distribution of OpenVINO toolkit

To address these challenges, GE Healthcare's R&D center, located in Wuxi, China, has designed and launched an innovative ultrasound hardware and software integration platform called Versana Premier. Powered by an Intel® Core™ processor, Versana Premier is used to optimize two-dimensional images and sensitive flow signals in an ergonomic system, as shown in Figure 1. The design facility used the Intel Distribution of OpenVINO toolkit during the development process to accelerate the AI inference algorithm that labels the liver, right kidney, and gallbladder.

Figure 1. GE Healthcare's Versana Premier ultrasound system.

AI labeling algorithm simplifies examination process

Versana Premier provides a capability called Whizz Label to automate the labeling of the liver, right kidney, and gallbladder in an ultrasound image. Ultrasound images are created when an object such as a human organ is insonated. When the reflections are received back, an image is constructed from the received signals, such as the one in Figure 2, which shows a liver, right kidney, and gallbladder.

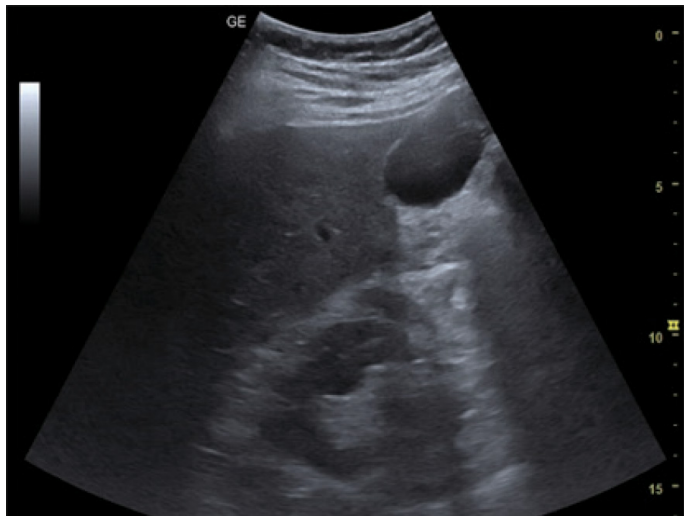


Figure 2. Ultrasound image without anatomy labeling.

GE Healthcare has built an algorithm based on deep learning neural networks that can identify which of the pixels in an image correspond to a liver, right kidney, or gallbladder. These organs each have a specific texture and speckle pattern in an image. The algorithm uses a series of convolution filters arranged in layers called a convolutional neural network (CNN) and applies them to each image frame. The texture around each pixel is examined using the filters in the CNN to determine if a particular pixel on the image belongs to the liver, right kidney, or gallbladder. The CNN has been built to identify these features and assess their relative locations in order to identify each organ. Versana Premier then labels the image with the organ names, as shown in Figure 3.

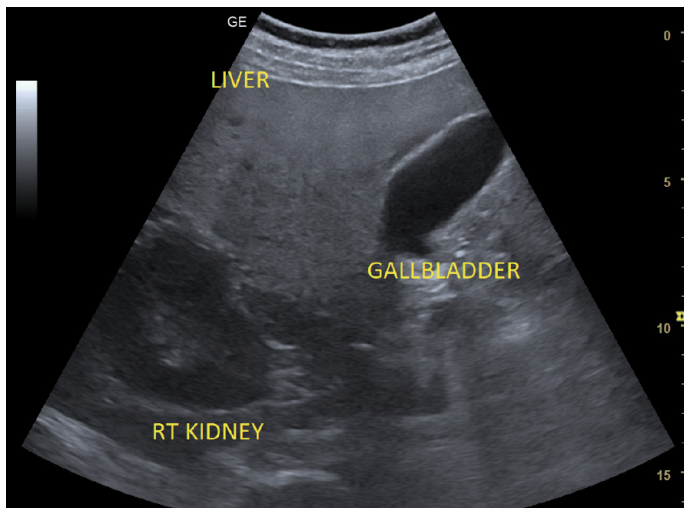


Figure 3. Ultrasound image with organs labeled.

Figure 4. Processing flow of the AI labeling algorithm in Versana Premier.

The processing flow of the AI object detection algorithm to label organs is shown in Figure 4. The clinician performs an ultrasonic inspection on the human body part, and an ultrasound image is created. Then, these images are preprocessed by the image engine, then image inference and postprocessing are performed based on the locked trained model.

Choosing the right technology for AI optimization

While training the model, GE Healthcare considered different options for AI model optimization by conducting performance testing. The Intel Distribution of OpenVINO toolkit with FP32 was selected because of its excellent performance. The inference performance was improved 5x by the Intel Distribution of OpenVINO toolkit compared with TensorFlow C API as shown in Figure 5.[2]

The Intel Distribution of OpenVINO toolkit, shown in Figure 6, helped the design team optimize the AI object detection algorithm to improve the inference performance on Intel® platforms. GE Healthcare used the toolkit's Model Optimizer to convert formats and optimize the graphs using framework-agnostic transformation techniques, including constant folding, batch norm fusing, and pad fusion. The model inference was accelerated by the OpenVINO Inference Engine API; the inference engine relies on the Intel® Math Kernel Library for Deep Neural Networks (Intel® MKL-DNN). In this case, GE Healthcare chose Intel Core processors that use the FP32 data format for deep learning models.

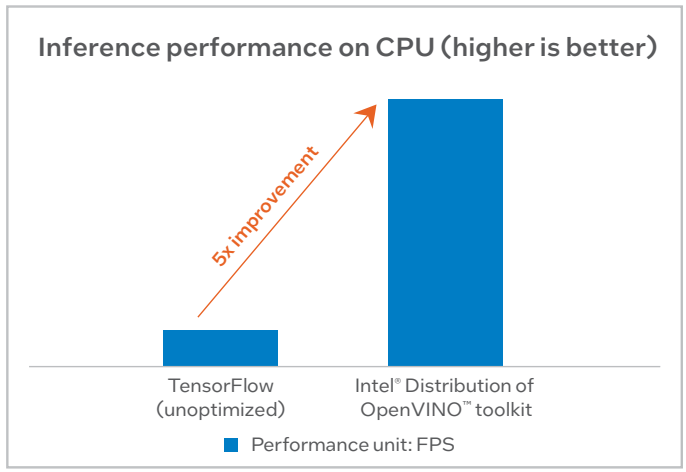
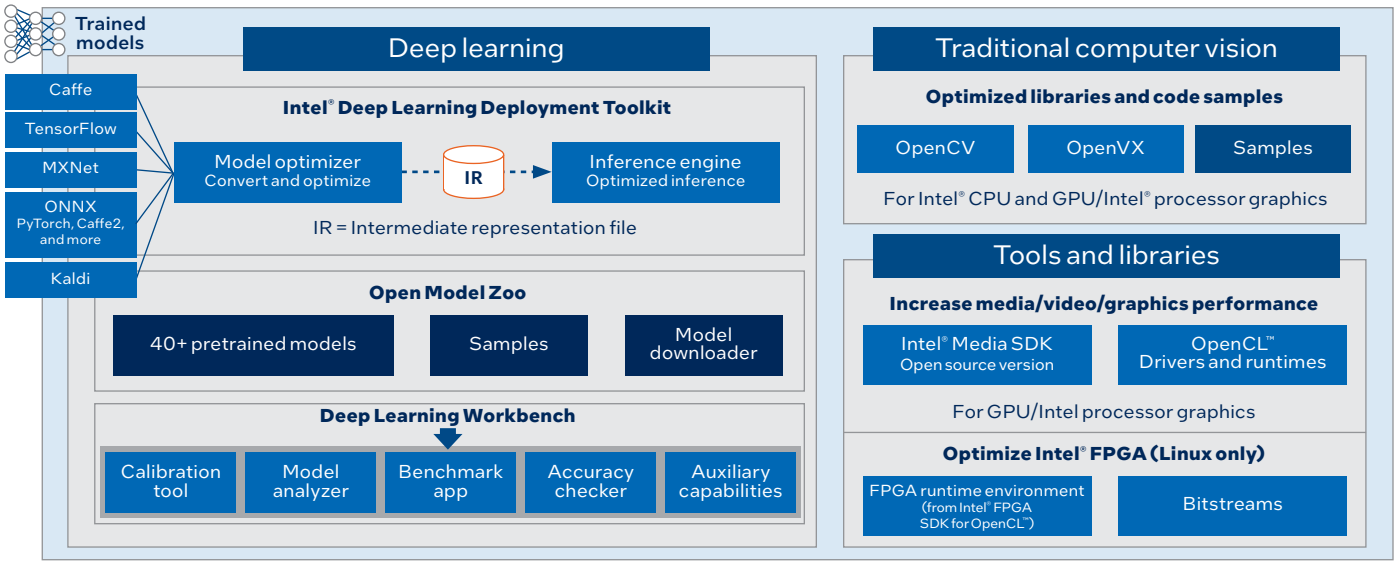
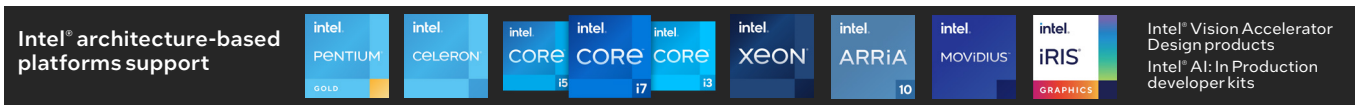


Figure 5. Performance improvement with the Intel® Distribution of OpenVINO™ toolkit. See backup for workloads and configurations. Results may vary.[2]



Supported OS: CentOSs 7.6 (64 bit), Ubuntu 18.04 LTS and 20.04 LTS (64 bit), Microsoft Windows 10 (64 bit), Yocto 3.0 (64 bit), macOS 10.15 (64 bit)



An open source version is available at 01.org/openvinotoolkit (some deep learning functions support Intel CPU/GPU only).

Figure 6. Intel® Distribution of OpenVINO™ toolkit.

Result: Automated features on Versana Premier support clinicians in healthcare facilities

Versana Premier's Whizz Label AI algorithm helps to support workflow efficiency when labeling the liver, right kidney, or gallbladder. In addition to the AI-powered Whizz Label feature, other automated tools on the Versana Premier ultrasound system support the clinician workflow while consistently providing a high level of image quality. For medical institutions, the overall impact is to bring high-quality ultrasound diagnostic capabilities to a wide range of populations.

GE Healthcare works with Intel to enable the future of healthcare

GE Healthcare continues to explore new ways to support clinicians by improving efficiencies using AI technologies. With decades of technological and clinical experience, GE Healthcare is integrating leading technologies into its products to offer advanced healthcare solutions to clinicians, accelerating the transformation to the smart hospital, and helping to bring improved outcomes with lower costs in healthcare services.

Intel is cooperating with companies like GE Healthcare to explore the deeper application of accelerators to leverage end-to-end technological capabilities and harness the power of AI in the healthcare industry.

About GE Healthcare

GE Healthcare enables clinicians to make faster, more informed decisions through intelligent devices, data analytics, applications, and services, supported by its Edison intelligence platform. As a leading global medical technology, diagnostics, and digital solutions innovator, GE Healthcare also has over 100 years of healthcare industry experience and nearly 50,000 employees globally. The company operates at the center of an ecosystem working toward precision health, digitizing healthcare, and helping drive productivity and improve outcomes for patients, providers, health systems, and researchers around the world. We embrace a culture of respect, transparency, integrity, and diversity.

gehealthcare.com

Learn more

Learn more about Versana Premier at **gehealthcare.com/products/versana-premier-us**.

Learn more about Intel® technologies:

intel.com/health

intel.com/ai

intel.com/openvino

1. "Ultrasound Equipment Market Size, Share & COVID-19 Impact Analysis, By Product (Compact, and Table-top), By Application (Radiology, Gynecology, Cardiology, Point of Care, Urology, Surgery and Others), By End User (Hospitals & Clinics), and Regional Forecast, 2021–2028." Fortune Business Insights, September 2021. https://www.fortunebusinessinsights.com/industry-reports/ultrasound-equipment-market-100515
2. Testing performed by GE Healthcare in December 2020. Test configuration:

Processor	Intel® Core™ i3-6100E CPU @2.70 GHz—2.71 GHz
Memory	4 GB
OS	Windows 10 Enterprise LTSC
Software	Intel® Distribution of OpenVINO™ toolkit 2019.2.242

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