

Solution Brief

Healthcare
Medical Imaging with AI



Huiying Medical CT Scanning Solution Aids Early Detection of COVID-19 Infections

Exceeding requirements and delivering low TCO using the Intel® Distribution of OpenVINO™ toolkit for deep learning inference on Intel Xeon® Gold 6252N processors

INTEL®
AI BUILDERS
MEMBER

HY 汇医慧影
huiyihuiying.com

According to the World Health Organization (WHO), U.S. Centers for Disease Control (CDC), and other organizations around the world, COVID-19 has infected over 20 million individuals with over a half-million deaths, while 5.6 million have recovered from the disease.¹ As COVID-19 continues to sweep around the world, early testing remains the most important aspect of diagnosis, containment, and treatment.

The standard testing method for the SARS-CoV-2 virus (the virus that causes the disease COVID-19) is Reverse Transcription-Polymerase Chain Reaction (RT-PCR). But many countries do not have ready access to the tests or the facilities to complete them in a timely manner, requiring days to weeks to attain results. Meanwhile, contagious individuals continue to be potential infection vectors to those around them.

Huiying Medical (HYHY), a leading developer of healthcare technology solutions in China, designs Artificial Intelligence (AI)-driven medical imaging analytics systems to aid early screening and diagnosis for a range of medical conditions. Their solutions include AI-based detection of lung nodules, tuberculosis, breast cancer, bone fractures, and others. Huiying Medical Technology is dedicated to applying computer vision and deep learning to the medical field. They have successfully deployed a system for early detection and diagnosis of COVID-19 infections using CT scans, complementing RT-PCR testing and helping identify suspected cases where lab testing is not readily accessible.

Huiying Medical has successfully deployed their CT scanning solution to over 20 hospitals throughout China to help fight against the spread of the disease. The company is actively seeking additional healthcare professionals and institution partners for the system.

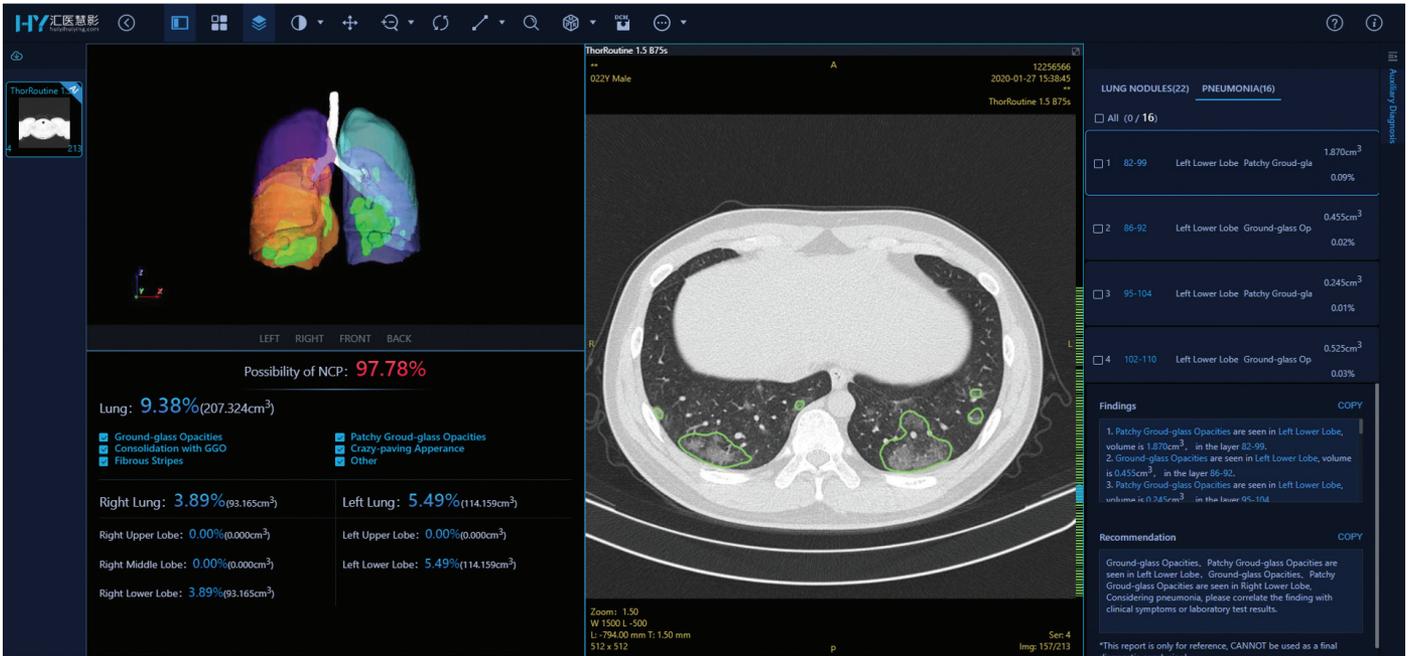


Figure 1. Huiying Medical's AI-enabled CT scanning for NCP helps clinicians detect potential SARS-CoV-2 infections early.

Huiying Medical Develops AI-enabled CT Analysis That Reveals COVID-19

Early symptoms of COVID-19 are indicated by respiratory impairments, including Novel Coronavirus Pneumonia (NCP) unique to COVID-19, which can show up in CT chest scans. Huiying Medical's AI-enabled diagnostic solution analyzes CT chest scans for indications of NCP and other conditions. The solution analyzes the ground-glass opacity (GGO) and other indicators revealed in the CT imagery (Figure 1). The analysis provides a probability of suspected infection to identify potential cases early in the cycle. Doctors and specialists will order and conduct further testing, and—more importantly— isolate suspected individuals early to help prevent the spread of the disease.

Huiying Medical's solution helps doctors quickly diagnose potential infections with more accuracy than RT-PCR testing alone. According to published research, the mean lead time in diagnosis of viral infection yielded by CT compared with laboratory results was 3 days² sooner with a sensitivity of 98% for CT compared to sensitivity of 71% (p<.001)³ for RT-PCR.

The results from Huiying Medical's AI solution are intended as a complementary diagnostic tool to standard lab testing. Lab testing remains the primary diagnosis in practice, and multiple chest scans are used to monitor the disease

progression. The AI-enabled CT scan analysis helps lead to early control of potential transmission, timely medical intervention, and better patient management. It thus plays a crucial role in the diagnosis and treatment process.

As healthcare professionals learn more about COVID-19, it is clear that early testing is critical to prevent infected patients from spreading the virus to others and at the same time provide treatment to sick patients. China's practices and experience have clearly shown that containment is critical in this battle against SARS-CoV-2 due to the highly infectious nature of the disease. Faster detection and diagnosis provided by CT scanning could help save lives.

Optimizations Accelerate Results by 2.89X⁴

Huiying's AI-enhanced CT screening technology for COVID-19 utilizes deep neural networks based on the Nested U-Net and HR-Net topologies. Their system was built using the TensorFlow framework and PyTorch deep learning library. Working with Intel, Huiying Medical's data scientists, engineers, and software developers optimized their model for 2nd Generation Intel® Xeon® processors using the Intel Distribution of OpenVINO toolkit to accelerate performance of computer vision workloads. Engineers also implemented Intel Optimizations for TensorFlow, and the Intel Math Kernel Library for Deep Neural Networks (Intel MKL-DNN) to accelerate inferencing.

The solution, consisting of a pipeline of segmentation, classification, and recognition models, was able to deliver overall diagnostic performance 2.89X faster on 2nd Gen Intel Xeon Gold 6252N processors with Intel optimization software and libraries (Figure 2) compared to non-optimized algorithms. Faster performance allows processing of more scans and generating results quicker, enabling treatment of more patients and offering better care.

The OpenVINO toolkit is a free software kit that helps developers and data scientists speed up AI inferencing workloads and streamline deep learning deployments from the network edge to the cloud across Intel architectures—CPUs, integrated GPUs, ASICs, and FPGAs.

AI-enabled CT Scanning Solution Deployments Are Growing

CT screening has played a critical role in China's efforts in early diagnosis and treatment of patients with COVID-19. The CT findings of lung abnormalities are particularly helpful in early detection of the infection where RT-PCR testing does not have high enough sensitivity in some cases. Huiying Medical's AI-powered CT imaging solutions can be deployed in the cloud or on premise. The COVID-19 scanning system is able to achieve as high as 96% accuracy rate in classification of Novel Coronavirus Pneumonia (NCP)⁵

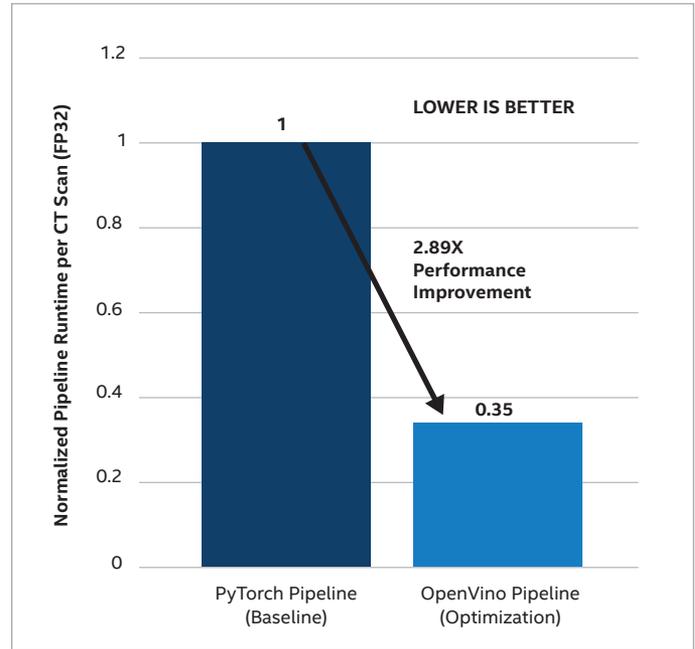


Figure 2. Latency reduction due to OpenVINO implementation and optimizations on 2nd Gen Intel Xeon Gold 6252N processors.

Conclusion

Huiying Medical, an Intel AI Builder program member, has developed a medical imaging diagnostic solution using CT chest scans to assist early detection of SARS-CoV-2 infection, complementing standard lab testing. They have integrated the solution in over 20 hospitals throughout China and subsequently introduced it to other countries to address use cases overseas. With the help of Intel engineers, Huiying Medical was able to use the Intel Distribution of OpenVINO to drive more rapid image analysis and diagnoses through their AI-enabled solution.

For more information about Huiying Medical, visit <http://en.huiyihuiying.com/>.

Learn more about the Intel AI Builders program at <https://builders.intel.com/ai/membership>.

Learn more about Intel Distribution of OpenVINO at intel.com/openvino



Huiying Medical is an AI-powered high-tech company offering assistive solutions for medical image screening and diagnosis. With the technologies of artificial intelligence, cloud computing and big data, Huiying Medical is committed to create intelligent digital and mobile medical imaging.

¹ <https://www.worldometers.info/coronavirus/>

² www.doi.org/10.2214/AJR.20.22954

³ <https://pubs.rsna.org/doi/10.1148/radiol.2020200432>

⁴ Testing conducted by Intel on 5/5/2020.
BASELINE: 2S Intel® Xeon® Gold 6252N CPU @ 2.30GHz, 24 cores, turbo and HT on, BIOS 4.1.13, 192GB total memory, Ubuntu 18.04.4 LTS
Software: PyTorch: 1.5.1; TorchVision: 0.6.1; Onnx: 1.6.0
NEW: 2S Intel® Xeon® Gold 6252N CPU @ 2.30GHz, 24 cores, turbo and HT on, BIOS 4.1.13, 192GB total memory, Ubuntu 18.04.4 LTS
Software: OpenVino R2020.3.194

⁵ Based on HYHY internal testing:
Total CT DICOM Chest imaging studies: 627
Confirmed COVID-19 imaging studies: 200
Pneumonia of other kinds imaging studies (Non-COVID-19 viral Pneumonia, Fungus Pneumonia, Gram Pneumonia, etc.): 225
Non-pneumonia imaging studies: 202
Classification Model of COVID-19/ non-COVID-19: • Recall: 0.87 • Specificity: 0.98 • Accuracy: 0.96

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.

Intel's compilers may or may not optimize to the same degree for non-Intel microprocessors for optimizations that are not unique to Intel microprocessors. These optimizations include SSE2, SSE3, and SSSE3 instruction sets and other optimizations. Intel does not guarantee the availability, functionality, or effectiveness of any optimization on microprocessors not manufactured by Intel. Microprocessor-dependent optimizations in this product are intended for use with Intel microprocessors. Certain optimizations not specific to Intel microarchitecture are reserved for Intel microprocessors. Please refer to the applicable product User and Reference Guides for more information regarding the specific instruction sets covered by this notice. Software and workloads used in performance tests may have been optimized for performance only on Intel microprocessors.

Performance tests, such as SYSmark and MobileMark, are measured using specific computer systems, components, software, operations and functions. Any change to any of those factors may cause the results to vary. You should consult other information and performance tests to assist you in fully evaluating your contemplated purchases, including the performance of that product when combined with other products. For more complete information visit: <http://www.intel.com/performance>.

© Intel Corporation. Intel, the Intel logo, and other Intel marks are trademarks of Intel Corporation or its subsidiaries. Other names and brands may be claimed as the property of others. 0820/AU/HBD/PDF ♻️ Please Recycle 343786-001US

