

SOLUTION BRIEF

Healthcare
AI-Based Medical Imaging Solutions



AI-Driven Solutions Improve Healthcare Access and Quality

JLK Inspection's MobiDo-x and Atroscan products, optimized with the Intel® Distribution of OpenVINO™ toolkit, can help medical professionals reach more people, accelerate screening, and help improve quality of patient care.

According to Frost & Sullivan, healthcare solutions based on artificial intelligence (AI) have the potential to improve patient outcomes by up to 40 percent.¹ One of the most promising areas in which AI-driven solutions can improve healthcare is medical imaging—the MRIs, CT scans, X-rays, and other clinical tools used to diagnose, treat, and evaluate the progress of many diseases. Integrating AI into these data-intensive devices has the potential to greatly enhance their accuracy and efficiency, enabling delivery of better care to more people worldwide.

JLK Inspection has developed two AI-based medical imaging solutions, both of which use Intel® NUC Mini PCs and are optimized using the Intel® Distribution of OpenVINO™ toolkit. The first product, MobiDo-x, is a portable medical diagnosis platform that helps mobile providers perform on-site X-rays in remote areas. The second product, Atroscan, analyzes brain aging to give hospital-based physicians insights they can use to diagnose patients more quickly and accurately.

JLK Inspection's innovative solutions demonstrate how AI is rapidly transforming healthcare—and giving medical professionals the tools they need to do their work faster and more effectively, resulting in better patient outcomes.

AI-empowered platform supports anytime, anywhere screening

MobiDo-x is a mobile medical diagnosis platform designed to overcome challenges related to effectively screening, diagnosing, and treating tuberculosis (TB) and other lung diseases in remote areas and emerging countries.

TB is among the 10 deadliest diseases in the world, sickening 10 million people in 2018 and leading to the deaths of 1.5 million.² TB is a bacterial infection often found in the lungs, and underground mines are one of the highest-risk environments for TB transmission. For example, in South Africa the rate of TB among miners is 15 times higher than for the rest of the country's population and 2,000 times higher than the rate of TB in the United States.³

Early detection—which is possible via X-rays of affected individuals' lungs—is critical to successful recovery from TB, but there are significant barriers to screening for miners and others who live and work in remote areas. With limited or no internet access available, mobile X-ray machines cannot transmit medical images for evaluation by radiologists, and radiologists are rarely available to travel in person to remote areas.



Fast, accurate, affordable screening for TB

MobiDo-x addresses the challenges related to screening for TB in remote areas by integrating with third-party X-ray machines for easy transport to mines and other rural locations. The platform resides within an ultracompact Intel® NUC8i7HVK powered by an Intel® Core™ i7-8809G processor.

MobiDo-x has been deployed as a screening tool by the Korean National Tuberculosis Association, an organization that aims to eradicate TB in Korea, and at Nemoto Hospital in Japan. Future deployments are expected to target TB and other lung diseases in remote areas of India and South Africa.

In a typical scenario, a medical vehicle transports the X-ray machine with integrated MobiDo-x to a remote mine. Dozens to hundreds of miners can be screened within hours, with no need for an on-site radiologist or internet access to transmit images. Instead, JLK Inspection's AI models analyze the X-rays on-site to identify any of 15 lung abnormalities, including TB and other respiratory illnesses, based on National Institutes of Health (NIH) standards. The mobile medical team can transport miners who have been identified by MobiDo-x as likely suffering from a lung-based illness to cities for diagnosis and treatment.

With an area under the curve (AUC) of .94, MobiDo-x is an extremely accurate screening tool. The platform was developed using training data from more than 1.1 million chest X-rays provided by the Korean National Tuberculosis Association. Through AI-empowered X-ray image analysis, the system provides medical teams with both the probability of lung disease and a heat map visualization of suspected lesions that clearly indicates the location of abnormalities.

Initial testing by the Korean National Tuberculosis Association's mobile X-ray team found that MobiDo-x operated successfully in the field and accurately identified lung diseases that could then be treated by professionals in urban settings. By reaching affected individuals faster, screening them quickly on-site, and connecting them to treatment options, MobiDo-x has the potential to both improve patient outcomes and reduce the further spread of illness within mines and at other remote locations.

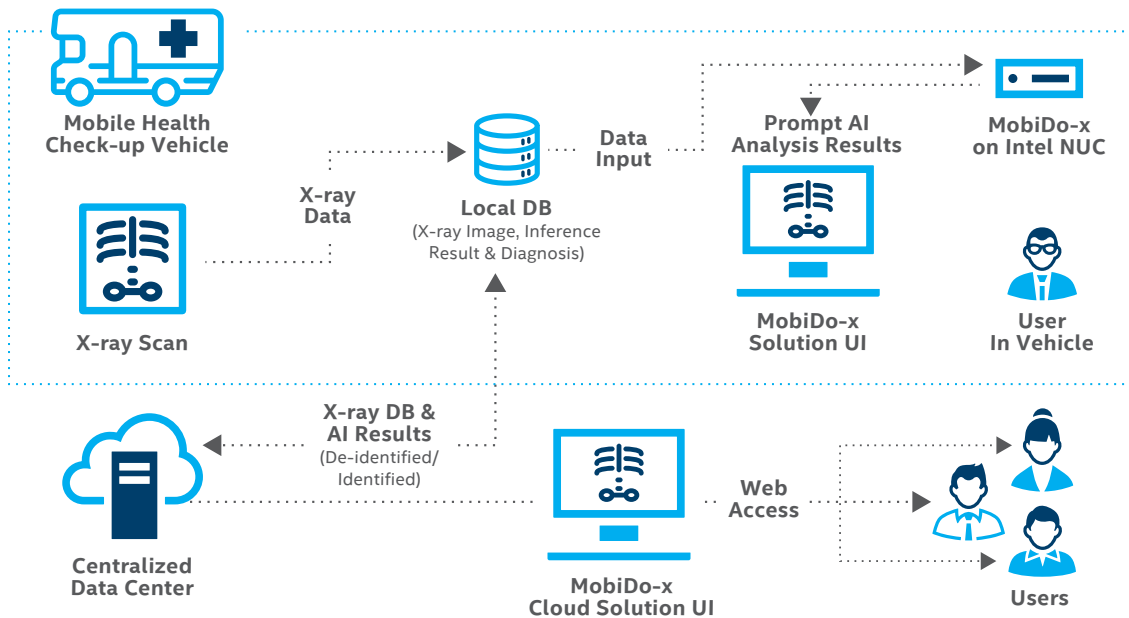


Figure 1. MobiDo-x integrates with a third-party imaging device to analyze lung scans on-site and provide clear clinical support to mobile medical teams so they can decide which individuals should be transported to receive medical care.

MobiDo-x key benefits

- **Easy integration:** Integrates with most third-party X-ray or other imaging devices
- **Small size:** Resides on an ultracompact Intel® NUC8i7HVK (221 x 142 x 39 mm)
- **Accurate screening:** Tests show an AUC of .94, demonstrating extremely accurate performance
- **Clear classifications:** Identifies, classifies, and labels 15 lung abnormalities, including TB
- **Diagnostic support:** Clinical information clearly displayed, with an annotation tool to mark lesions
- **Simple patient management:** Links to a picture archiving and communication system (PACS) for patient data management and provides full analysis and a report to medical teams

AI-based brain aging and dementia analysis

A second innovative product from JLK Inspection, Atroscan, demonstrates the breadth of possibilities for AI-based healthcare solutions. Atroscan—an AI-based medical solution housed on an Intel® NUC powered by an Intel Core i7-8809G processor—analyzes brain aging and the progression of dementia by categorizing 3D MRI images of the brain and analyzing cortical thickness by brain region. Designed for easy deployment in hospitals, Atroscan can provide diagnostic assistance to physicians and aid in physician education.

Because brain aging is closely related to cognitive dysfunction and dementia, it is critical for physicians to monitor and evaluate over time. This can be done in part by examining the thickness of the cerebral cortex, which is an important indicator of brain aging. The challenge is that the brain's cortex is an extremely complex region of the brain, with 62 separate parts that must be classified and evaluated.

With the help of 3D convolution neural network technology, Atroscan uses patient MRIs to classify each region of the brain's gray matter, calculate cortical thickness, and estimate the overall status of brain aging. Physicians can review Atroscan's 3D heat map visualizations, which color code each of the 62 regions of the cortex, displaying the cortical thickness of each for rapid review.

Further advantages of Atroscan are its speed and simplicity. Hospitals do not need to install software or connect Atroscan to the internet—they can simply connect the Intel NUC to a monitor and other input devices. And, unlike competitive solutions that can take up to 24 hours to perform a single analysis, Atroscan's state-of-the-art deep learning algorithm requires just 15 minutes per analysis.

Atroscan also provides physicians with user-friendly follow-up reports that include personalized analysis and visualization of each patient's brain changes over time, comparing current cortical thickness with the patient's historical measurement data

Atroscan key benefits

- **Easy integration:** Connects with third-party MRIs and other imaging devices
- **Rapid results:** Performs full data analyses within 15 minutes
- **Color-coded classifications:** Provides AI-based classifications of 62 regions of the cerebral cortex
- **Clear visualizations:** Provides heat map visualizations of cortical thickness measurements across 62 regions
- **User-friendly reports:** Offers personalized follow-up analyses of patient changes over time
- **Simple patient management:** Links to a picture archiving and communication system (PACS) for patient data management

Optimizing AI-based imaging solutions with the Intel Distribution of the OpenVINO toolkit

Intel helped optimize the AI algorithms used by MobiDo-x and Atroscan with the Intel Distribution of OpenVINO toolkit. The toolkit provided computer vision and deep learning inference tools, including convolutional image-based classification models optimized for the Intel® processors used in JLK Inspection's solutions.

To reduce the average inference time per case for [MobiDo-x or Atroscan], JLK Inspection and Intel tested multiple deployment options on both workstations and Intel NUCs. Deploying on a workstation would reduce the solution's mobility, and using systems with a GPU was a concern because of the potential maintenance issues.

By optimizing with the OpenVINO toolkit, JLK Inspection was able to reduce the average inference time on the Intel NUC (with no GPU) from 4.23 seconds to just 2.81 seconds per case. Intel also helped train the JLK Inspection team to get the most out of its algorithms going forward.

Intel Distribution of OpenVINO toolkit

The Intel Distribution of OpenVINO toolkit is a free, downloadable toolkit that helps developers fast-track the development of high performance computer vision and deep learning into vision applications. It enables deep learning on hardware accelerators and streamlined heterogeneous execution across multiple types of Intel® platforms. It includes the Intel® Deep Learning Deployment Toolkit with a model optimizer and inference engine, along with optimized OpenCV and OpenVX libraries and functions for computer vision. This comprehensive toolkit supports the full range of vision solutions, speeding computer vision workloads, streamlining deep learning deployments, and enabling easy, heterogeneous execution across Intel platforms from device to cloud.

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

AIHub platform accelerates innovation

Both MobiDo-x and Atroscan are built on JLK Inspection's AIHub platform, an all-in-one medical platform that applies AI and big data technology to medical images to help predict, monitor, and diagnose a variety of illnesses. Using seven unique modalities, AIHub can quickly analyze medical images and provide diagnostic support for 37 diseases related to 14 parts of the body.

AIHub stands apart from competitive solutions in five key areas:



Image processing. The platform uses multiple image processing techniques to enhance and analyze 3D and 2D images from MRIs, CT scans, mammograms, X-rays, colonoscopies, and other devices.



Artificial intelligence. JLK Inspection has developed unique AI engines, neural network solvers, and libraries and optimized them with the OpenVINO toolkit.



Integration. AIHub is built to connect seamlessly with all types of medical imaging machines and PACS solutions. Each product is based on the OpenVINO toolkit and can be installed on any computer—including small form factor Intel NUCs—that are compatible with OpenVINO-based authorizations.



Big data. More than a decade of medical data, annotated and verified by board-certified physicians with years of experience in the field, has been incorporated as part of AIHub, enabling creation of accurate and reliable models for disease detection, segmentation, and diagnostic support.



Scalability. AIHub is built with multiple AI modules that act as building blocks for individual solutions such as MobiDo-x and Atroscan. Instead of creating each healthcare solution from scratch, JLK Inspection can implement updates quickly and customize its existing modules to address different challenges.

About JLK Inspection

JLK Inspection is a medical solutions provider based in Seoul, South Korea, that specializes in AI-based technology. JLK's universal AI platform, AIHub, combines big data with proprietary engines and algorithms to provide innovative healthcare solutions that integrate with medical imaging devices to improve screening, diagnosis, and treatment of a variety of diseases and conditions.

Transforming healthcare with AI-based solutions

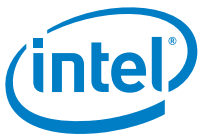
Through its AIHub platform and MobiDo-x and Atroscan products, JLK Inspection is demonstrating how AI-driven solutions can expand access to medical care, support more-accurate diagnoses, and ultimately improve patient outcomes.

By optimizing with the OpenVINO toolkit and integrating its products with the Intel NUC, JLK Inspection has created AI-based solutions that are more mobile and flexible, making it easier to reach more people and connect to more imaging systems. Through innovations like these, AI-driven solutions from JLK Inspection have the potential to help people around the world live longer and healthier lives.

Learn More

To learn more about JLK Inspection and its AI-based MobiDo-x and Atroscan solutions, contact a JLK Inspection representative at support@jlk-inspection.com.

Learn about the full range of AI tools available for developers and explore other ways companies are using Intel® technologies to power AI at intel.ai.



1. Frost & Sullivan. "From \$600 M to \$6 Billion, Artificial Intelligence Systems Poised for Dramatic Market Expansion in Healthcare," Jan. 5, 2016.
2. <https://www.who.int/news-room/fact-sheets/detail/tuberculosis>.
3. <https://www.cdc.gov/globalhivtb/who-we-are/features/miningcommunity.html>.

Intel technologies' features and benefits depend on system configuration and may require enabled hardware, software, or service activation. Performance varies depending on system configuration. No product or component can be absolutely secure. For more complete information about performance and benchmark results, visit intel.com/benchmarks.

Intel does not control or audit third-party data. You should review this content, consult other sources, and confirm whether referenced data are accurate.

© 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.

1219/RK/CMD/PDF