





Lunit, abbreviated from “learning unit,” is a medical AI software company devoted to developing advanced medical image analytics and novel imaging biomarkers via cutting-edge deep learning technology.

Founded in 2013, Lunit has been internationally acknowledged for its advanced, state-of-the-art technology and its application in medical images. Lunit is based in Seoul, South Korea.

# PERFECTING INTELLIGENCE, TRANSFORMING MEDICINE.

---

## Why Lunit?

---

With the recent breakthrough in machine learning and the large-scale digital medical data in hospitals, the world of medicine is entering into a new era of data-driven medicine.

Despite the advance, currently 28% of lung cancer and 32% of breast cancer cases are left unidentified and misdiagnosed. High portion of medical cost is also gone wasted, with 95% of mammography being false positive and 50% of diagnostic tests are considered unnecessary.

We want to change that. We believe that improving diagnostic accuracy and reducing medical costs is key in providing quality care for patients. We are confident that our products can provide not just *improved*, but *the best* accuracy and efficiency possible.

**99% Target Accuracy Level, Always.**

Lunit's mission is to empower physicians with clinically actionable insights that foster accurate and cost-efficient diagnosis and treatment through unprecedented AI-powered imaging biomarkers with cutting-edge, world-leading accuracy.

Through our state-of-the-art deep learning technology trained with a vast amount of carefully curated, quality medical data, we would like to become a leader and pioneer in transforming medicine into the next level.

For us to achieve this mission, we strive to make the performance level of our technology and products exceptional, under our corporate vision, "*Perfecting Intelligence, Transforming Medicine*".

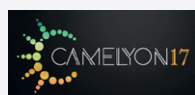
## STRONG AI TEAM MEETS A STRONG MEDICAL TEAM

### Strong AI team + Strong Medical team

We have more than 20 deep learning experts working full-time to reach the pinnacle of technology. Our AI team was internationally acclaimed in competitions, ranking top places at ImageNet 2015, Tumor Proliferation Assessment Challenge 2016, and Camelyon 2017, surpassing top companies like Google, IBM, and Microsoft.

Lunit was chosen by CB Insights as one of top AI startups in the healthcare industry and was recognized by NVIDIA as Top 5 AI startups for social impact.

Our medical team consists of 6 full-time, board-certified medical directors and more than 15 part-time staff radiologists/pathologists. They steer overall clinical direction, ensuring collection of large-scale high quality medical data and are directly involved in providing expert opinion everytime our AI algorithms are updated. Many of our studies and papers have been published at prestigious publications, as recently at <Radiology>.

The logo for ImageNet, featuring the word "IMAGENET" in a sans-serif font with a small graphic of three colored dots (green, orange, red) above the letter "G".The logo for MICCAI 2016 Athens, featuring the text "MICCAI 2016" in blue and "Athens" in red script, with smaller text below indicating it is the 18th International Conference on Medical Image Computing and Computer-Assisted Intervention.The NVIDIA logo, featuring a green stylized eye icon above the word "NVIDIA" in a bold, black, sans-serif font.The CB Insights logo, featuring a blue square icon with a white "C" and "B" inside, followed by the text "CBINSIGHTS" in a blue, sans-serif font.The Camelyon 17 logo, featuring a stylized graphic of a network or cluster of nodes in green and yellow, with the text "CAMELYON17" in a bold, black, sans-serif font.The Dream Challenges logo, featuring the word "DREAM" in a large, blue, sans-serif font, with "CHALLENGES" in a smaller, blue, sans-serif font below it, and "powered by Sage Bionetworks" in a small, black, sans-serif font at the bottom.The Radiology logo, featuring the word "Radiology" in a large, blue, serif font.The Scientific Reports logo, featuring the words "SCIENTIFIC" and "REPORTS" in a blue, sans-serif font, with a red gear icon between the two words.The Clinical Infectious Diseases logo, featuring the text "Clinical Infectious Diseases" in a blue, serif font.The RSNA 2018 Tomorrow's Radiology Today logo, featuring the text "RSNA 2018" in a blue, sans-serif font, "TOMORROW'S" in a bold, black, sans-serif font, and "RADIOLOGY TODAY" in a smaller, black, sans-serif font, with a colorful graphic of a stylized 'Y' or 'T' shape to the right.

---

## Competitive Data Acquisition

---

### 18 Partners Diverse Source

Through partnership with healthcare institutions all over the world, we are able to collect and curate large-scale data and conduct multi-center clinical studies. Our partnership institutions are located throughout the world, including US, South Korea, and UK.

### +1M Images Massive Scale

Collection and curation of large-scale medical imaging data is what makes our state-of-the-art AI algorithms. We make sure to collect high-quality data, which so far have reached over 1 million case images.

### F/U-confirmed Data Highest Quality

We collect confirmed data, not limited to suspected cases, but data with confirmed diagnosis and with robust ground truth, confirmed by pathology or further imaging data. Acquiring highest quality data enables development of our technology, transcending human vision.

# STATE-OF-THE-ART TECHNOLOGY

## Deep Learning Technology

Our proprietary, state-of-the-art deep learning technology combined with appropriate data construction enables us to achieve perfection in our intelligence, attaining super-human capabilities in detecting challenging cases, or cases not visible to the human eye.

Our technology had gained world recognition for its excellency and accuracy, along with its sophisticated level of digital craftsmanship.

## AI Abstract Presentations and Publications by Lunit

|                               |  |
|-------------------------------|--|
| CVPR 2015 DeepVision Workshop | Multi-scale Pyramid Pooling for Deep Convolutional Representation  |
| ICCV 2015                     | Attentionnet: Aggregating Weak Directions for Accurate Object Detection  |
| ECCV 2016                     | Pixel-Level Domain Transfer  |
| MICCAI 2016                   | Self-Transfer Learning for Fully Weakly Supervised Object Localization   |
| ICLR 2017 Workshop            | Transferring Knowledge to Smaller Network with Class-Distance Loss   |
| MICCAI 2017 DLMIA Workshop    | A Unified Framework for Tumor Proliferation Score Prediction in Breast Histopathology                              |
| MICCAI 2017 DLMIA Workshop    | Accurate Lung Segmentation Via Network-Wise Training of Convolutional Networks                                     |
| MICCAI 2018                   | Keep and Learn: Continual Learning by Constraining the Latent Space for Knowledge Preservation in Neural Networks  |
| MICCAI 2018                   | A Robust and Effective Approach Towards Accurate Metastasis Detection and PN-Stage Classification in Breast Cancer |
| CVPR 2018                     | Distort-And-Recover: Color Enhancement Using Deep Reinforcement Learning   |
| BMVC 2018                     | Bam: Bottleneck Attention Module   |
| ECCV 2018                     | Convolutional Block Attention Module   |
| NIPS 2018                     | Batch-Instance Normalization for Adaptively Style-Invariant Neural Networks  |

## OUR PRODUCTS



We aim to bring exceptional, clinically-approved accuracy to our products. The accuracy level of our diagnostic products currently ranges from 97% to 99% depending on the area of diagnosis.

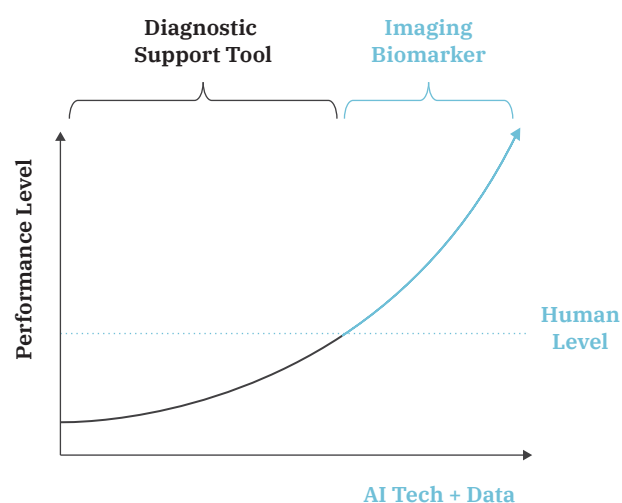
The location of detected lesions are shown in heatmap which also reflects the abnormality score. The higher the abnormality score, the heatmap is colored in red.

We also make our product most accessible for our users to improve productivity. Our products can be seamlessly integrated into the clinical workflow, deployed both on-prem and via cloud.

### Data-driven Imaging Biomarker

Our ultimate goal is to develop meaningful data-driven imaging biomarkers that would be clinically used to guide diagnosis and treatment. In this journey, we had been developing accurate diagnostic support tools for relatively simpler imaging tests such as chest x-ray.

So far, our algorithms have been proven to perform similarly or even better than experts at detecting specific lesions. Step-by-step, we are expanding the scope of our research to go beyond human vision into the realm of clinical outcome prediction.



# LUNIT INSIGHT FOR CHEST RADIOGRAPHY

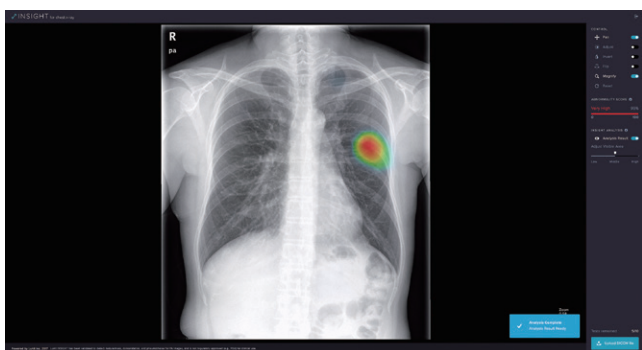
**97-99% AUC**  
Clinically Proven Cutting-edge Accuracy

Although chest radiography is the most commonly used — 25% of the annual total numbers of diagnostic imaging procedures, thus being the most fundamental imaging test — the interpretive performance is suboptimal, where 20-30% are reported to be missed. The ever growing burden for physicians is intensified with high volume of image to interpret.

Lunit INSIGHT for Chest Radiography is the solution to this problem. With an accuracy level that reaches 97-99%, it detects lung nodule/mass, consolidation and pneumothorax within seconds. Lunit INSIGHT for Chest Radiography was trained by over 200,000 chest x-ray images.

Lunit INSIGHT for Chest Radiography has been approved by Korea MFDS (Ministry of Food and Drug Safety) on August 2018. It is expected to get approval by FDA/CE soon.

You can login to <https://insight.lunit.io> to freely upload chest x-ray DICOM images and get real-time diagnosis results conducted by Lunit INSIGHT in no time.



Our AI solutions in the form of diagnostic support tools directly participate in the primary interpretation process of radiologists or general physicians. Detected lesions are presented in heatmap in addition to “abnormality scores”.

| Lunit WORKLIST VIEWER |                     |            |              |             |     |          |           |               |             |          |             |
|-----------------------|---------------------|------------|--------------|-------------|-----|----------|-----------|---------------|-------------|----------|-------------|
| MODALITY              |                     | AI RESULT  |              | EXAM STATUS |     |          |           | AI THRESHOLD  |             |          |             |
| No.                   | Exam Date / Time    | Patient ID | Patient Name | Sex         | Age | Modality | Body Part | Accession No. | AI Priority | AI Score | Exam Status |
| 1                     | 2018-04-01 10:00:00 | Assigned   | Assigned     | F           | 30  | CR       | Chest     | 0000          | LOW         | 99.99%   | Read        |
| 2                     | 2018-04-01 10:00:00 | Assigned   | Assigned     | F           | 30  | CR       | Chest     | 0000          | LOW         | 99.99%   | Read        |
| 3                     | 2018-04-01 10:00:00 | Assigned   | Assigned     | F           | 30  | CR       | Chest     | 0000          | LOW         | 99.99%   | Read        |
| 4                     | 2018-04-01 10:00:00 | Assigned   | Assigned     | F           | 30  | CR       | Chest     | 0000          | LOW         | 99.99%   | Read        |
| 5                     | 2018-04-01 10:00:00 | Assigned   | Assigned     | F           | 30  | CR       | Chest     | 0000          | LOW         | 99.99%   | Read        |
| 6                     | 2018-04-01 10:00:00 | Assigned   | Assigned     | F           | 30  | CR       | Chest     | 0000          | LOW         | 99.99%   | Read        |
| 7                     | 2018-04-01 10:00:00 | Assigned   | Assigned     | F           | 30  | CR       | Chest     | 0000          | LOW         | 99.99%   | Read        |
| 8                     | 2018-04-01 10:00:00 | Assigned   | Assigned     | F           | 30  | CR       | Chest     | 0000          | LOW         | 99.99%   | Confirm     |
| 9                     | 2018-04-01 10:00:00 | Assigned   | Assigned     | F           | 30  | CR       | Chest     | 0000          | LOW         | 99.99%   | Read        |

The results of our AI solutions can be used within the worklist, as an index to sort images according to abnormality, enabling decreased turnaround time and overall reading time.



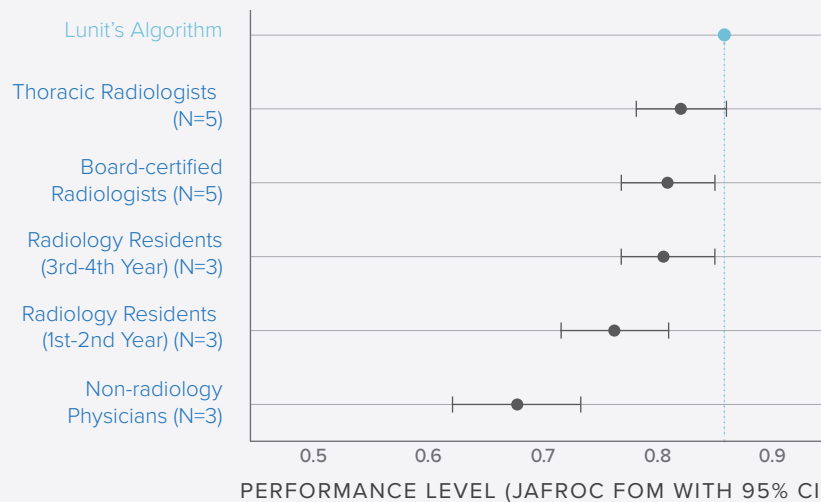
# READER STUDY FOR DETECTION OF LUNG NODULE IN CHEST RADIOGRAPHY

Nam JG, Park SG, et al. Development and Validation of Deep Learning-Based Automatic Detection Algorithm for Malignant Pulmonary Nodules on Chest Radiographs. *Radiology*. 2018 Sep 25;180237.

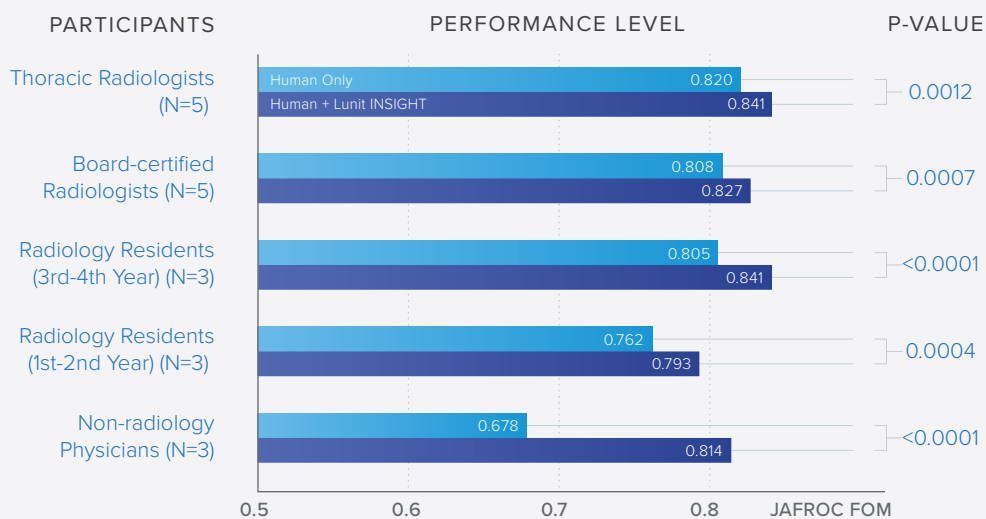
According to our reader study for detection of lung nodule in chest radiography, the accuracy of Lunit's algorithm was the highest among the entire group of readers, including thoracic radiologists and board-certified radiologists.

It has proven that with Lunit INSIGHT for Chest Radiography as a second reader, physicians of different expertise level showed statistically significant increase in performance in detecting pulmonary nodules in chest x-rays. For non-radiology physicians, the performance level significantly increased up to 20%.

## THE ACCURACY OF OUR ALGORITHM IS HIGH (IMAGE N=181)



## OUR ALGORITHM MAKES RADIOLOGISTS BETTER (IMAGE N=181)



Published at *Radiology*

## LUNIT INSIGHT FOR MAMMOGRAPHY

### 97% AUC for Breast Cancer Detection Clinically Proven Cutting-edge Accuracy

Breast cancer is one of the most common cancer that takes up 25% of the entire cancer and is the leading cause of death, at 15%, among women worldwide. Screening mammography is the only single modality proven to improve breast cancer survival, with a mortality reduction rate of around 20%.

However, accuracy of screening mammography is low, with false negative rates of 10-30% and false positive rates around 95%. Proportion of breast specialists reading screening mammograms is also low.

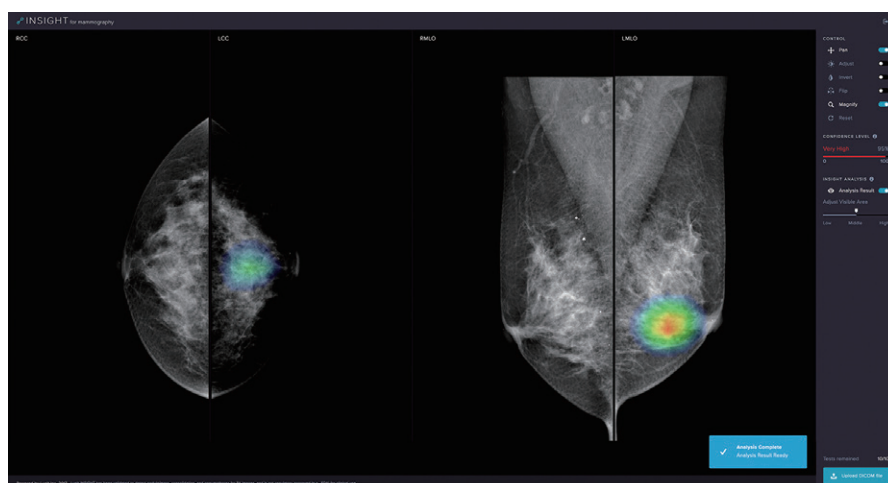
Lunit INSIGHT for Mammography provides solution to this problem by detecting breast cancer lesions with 97% accuracy within seconds after uploading the patient's mammography image to our software.

Lunit INSIGHT for Mammography was trained by over 200,000 mammography cases of which approximately 50,000 cases were from breast cancer patients.

Ultimately, our solution is expected to help radiologists make better decisions to recall a patient or not.

Lunit INSIGHT for Mammography is expected to get US Food and Drug Administration (FDA) and European CE mark approval within 2019.

You can login to <https://insight.lunit.io> to freely upload images and get real-time diagnosis results conducted by Lunit INSIGHT in no time.



Lunit INSIGHT for Mammography accurately locates lesions, shown by heatmaps. It also characterizes lesions to be malignant or benign via “abnormality scores,” and completely ignores benign lesions, ensuring optimal usability.

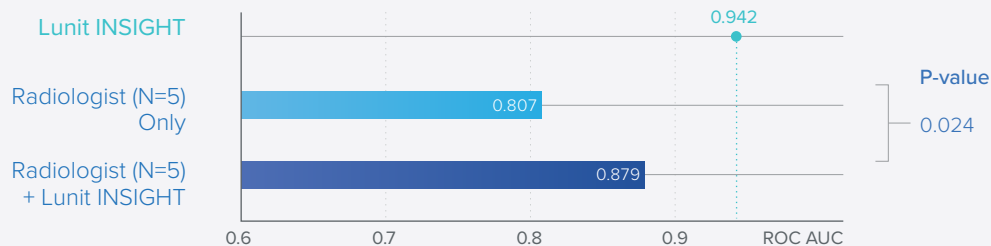
# READER STUDY RESULTS FOR MAMMOGRAPHY (RSNA 2018)

Data-Driven Imaging Biomarker for Breast Cancer Screening in Mammography-Reader Study, RSNA 2018

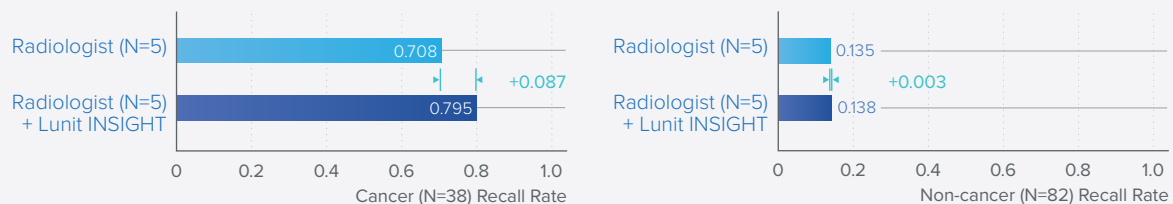
Clinical studies have shown Lunit INSIGHT for Mammography to enable radiologists to perform significantly better in detecting malignant cases, with increased performance level by 10%.

When Lunit INSIGHT for Mammography was directly compared to traditional CAD, its performance level was superior by a large margin, especially in terms of specificity, which has been the major issue with traditional CAD.

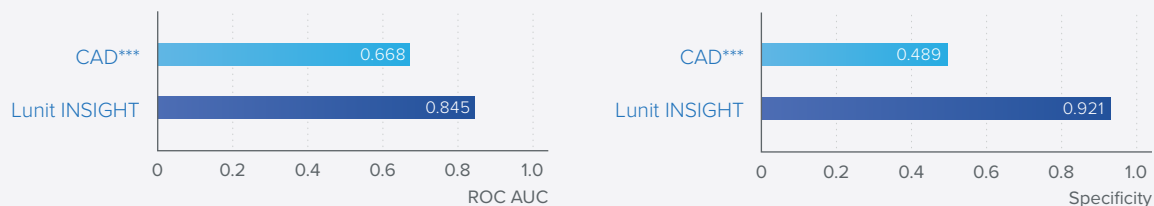
## COMPARISON WITH RADIOLOGISTS FOR CANCER DETECTION\* (EXAMS N=120)



## COMPARISON WITH RADIOLOGISTS FOR RECALL RATE\*\* (EXAMS N=120)



## COMPARISON WITH CAD\*\*\* FOR CANCER DETECTION (EXAMS N=76)



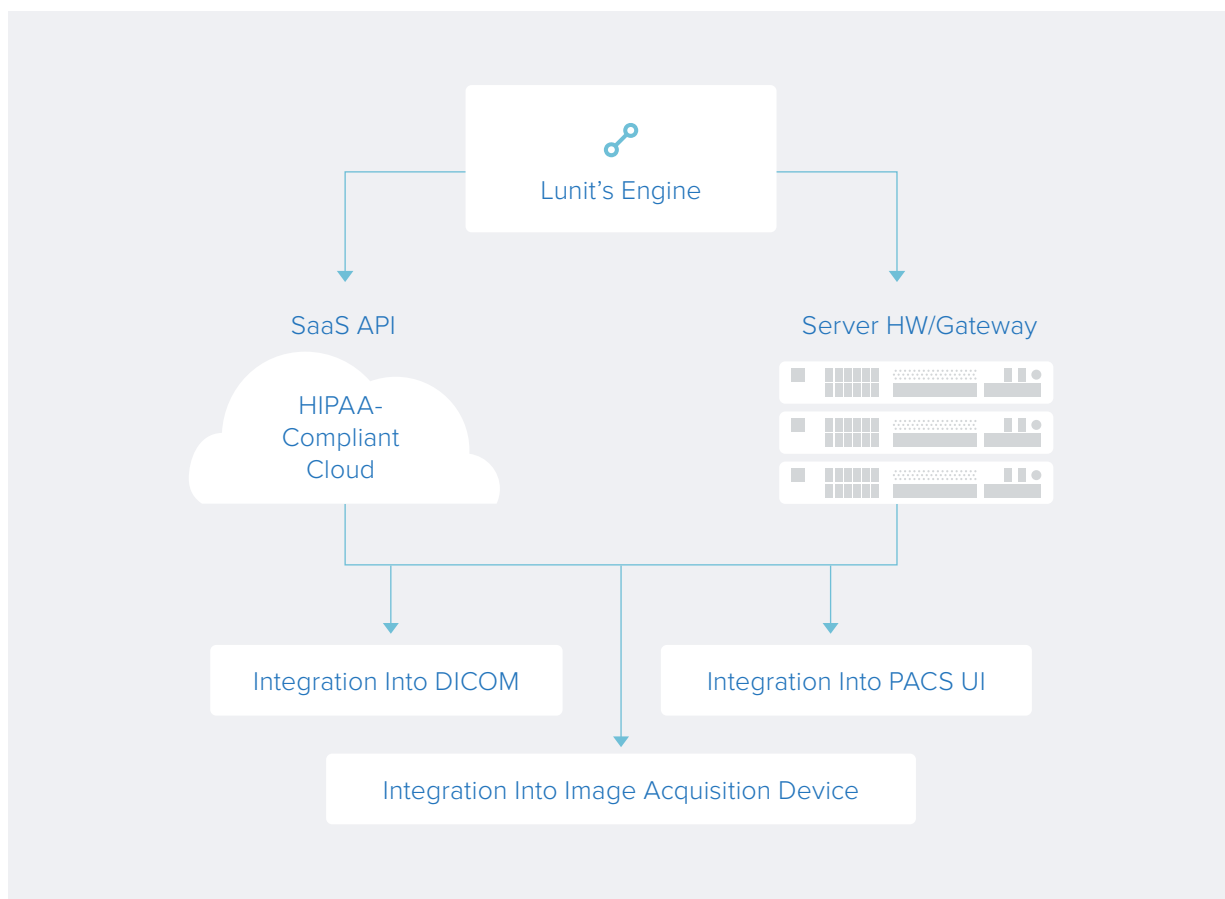
\* Based on reader's rating (DMIST 7pt score) for likelihood of malignancy (LOM) w/ and w/o Lunit INSIGHT

\*\* Based on reader's binary decision whether each case should be recalled w/ and w/o Lunit INSIGHT

\*\*\* CAD denotes analysis results from a commercially available computer aided detection software

## PRODUCT DEPLOYMENT

Our products are developed to be seamlessly integrated and applied in various clinical settings, available for deployment at institutions that use either cloud-based systems or on-premise hardware.



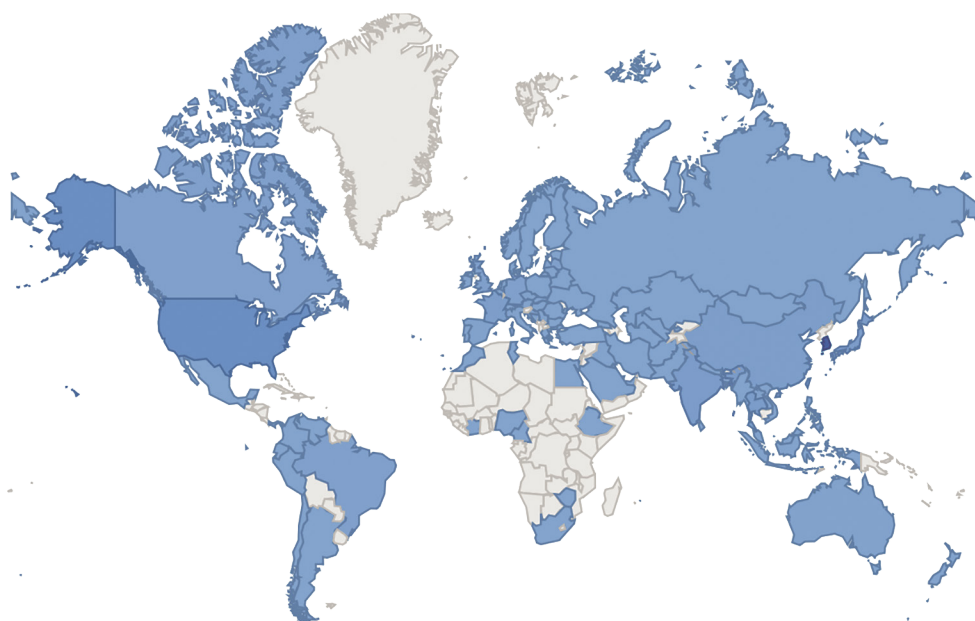
### Cloud Base SaaS API

Our products can be integrated into HTML5-based DICOM viewers or other forms of native application via RESTful API; HIPAA-compliance will be supported; suitable for cloud-based PACS system or other image sharing platforms.

### DICOM Gateway

Our products can be integrated into DICOM standard environment; there is no need to transfer data outside local premises when using on-premise hardware.

## WHERE OUR PRODUCTS ARE USED



**1.5M+**

Total Number of Images

**70+**

Total Number of Countries

Our products are being deployed and tested throughout the world in various reference sites, including Mexico, UAE, South Korea, and etc. As of November 2018, Lunit INSIGHT has analyzed a total number of 1.5 million images from over 70 countries around the world.

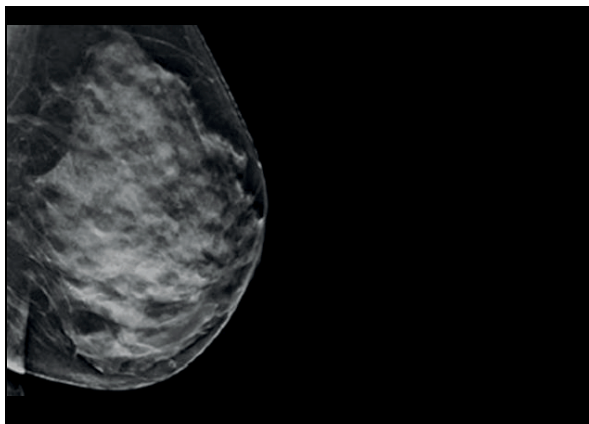
### Use Cases (As of November, 2018)

Our products have been used at tuberculosis (TB) screenings, in military settings, teleradiology firms, health check-up hospitals, and etc.

Our chest x-ray solutions are being applied in TB screening systems in Korea, simplifying a two-stop process of tuberculosis screening into a more efficient, one-stop process, in which sputum samples can be collected on site, right after the preliminary screening with our AI solution.

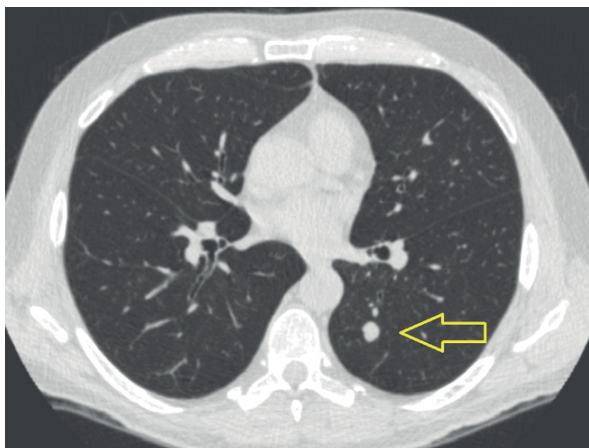
We also provide our solution to the Republic of Korea army, especially for remote and isolated military camps with limited access to specialists. Furthermore, our product serves as a solution for high-volume settings to “double-check” and make sure important findings are not left unnoticed.

## FUTURE PRODUCT DEVELOPMENT AREAS



### Digital Breast Tomosynthesis

DBT has been demonstrated by various large-scale studies to be superior to mammography in terms of breast cancer screening performance. We are using our experience in mammography research to develop a highly accurate diagnostic algorithm for breast cancer detection in DBT.



### Chest Computed Tomography

Lung cancer screening by low dose chest CT has been demonstrated to have survival benefit. Starting with accurate detection of lung nodules in chest CT, we plan to develop an imaging biomarker that accurately predicts malignancy of the detected nodules. Through the use of such imaging biomarker, not only will unnecessary invasive biopsy procedures may be avoided, but it may also be used to diagnose lung cancer at an earlier stage.



### Coronary Computed Tomography Angiography

Coronary heart disease is one of the most critical health issues throughout the world. Highly accurate prediction of fractional flow reserve and major coronary events by in stable angina and/or high risk asymptomatic patients is being pursued. This would enable appropriate selection of high risk patients to receive early revascularization, as well as avoid unnecessary revascularizations in patients who would not benefit from aggressive treatment.

## PARTNER WITH US

**We are looking for worldwide partnership with healthcare providers and companies interested in integrating our products and services.**

Please reach out via email to [partner@lunit.io](mailto:partner@lunit.io) for inquiries.

---

### Corporate Partners

---









---

### Investors

---










---

### Contact Us

---

Please feel free to email us about any inquiries or questions.

[contact@lunit.io](mailto:contact@lunit.io)  
[www.lunit.io](http://www.lunit.io)



