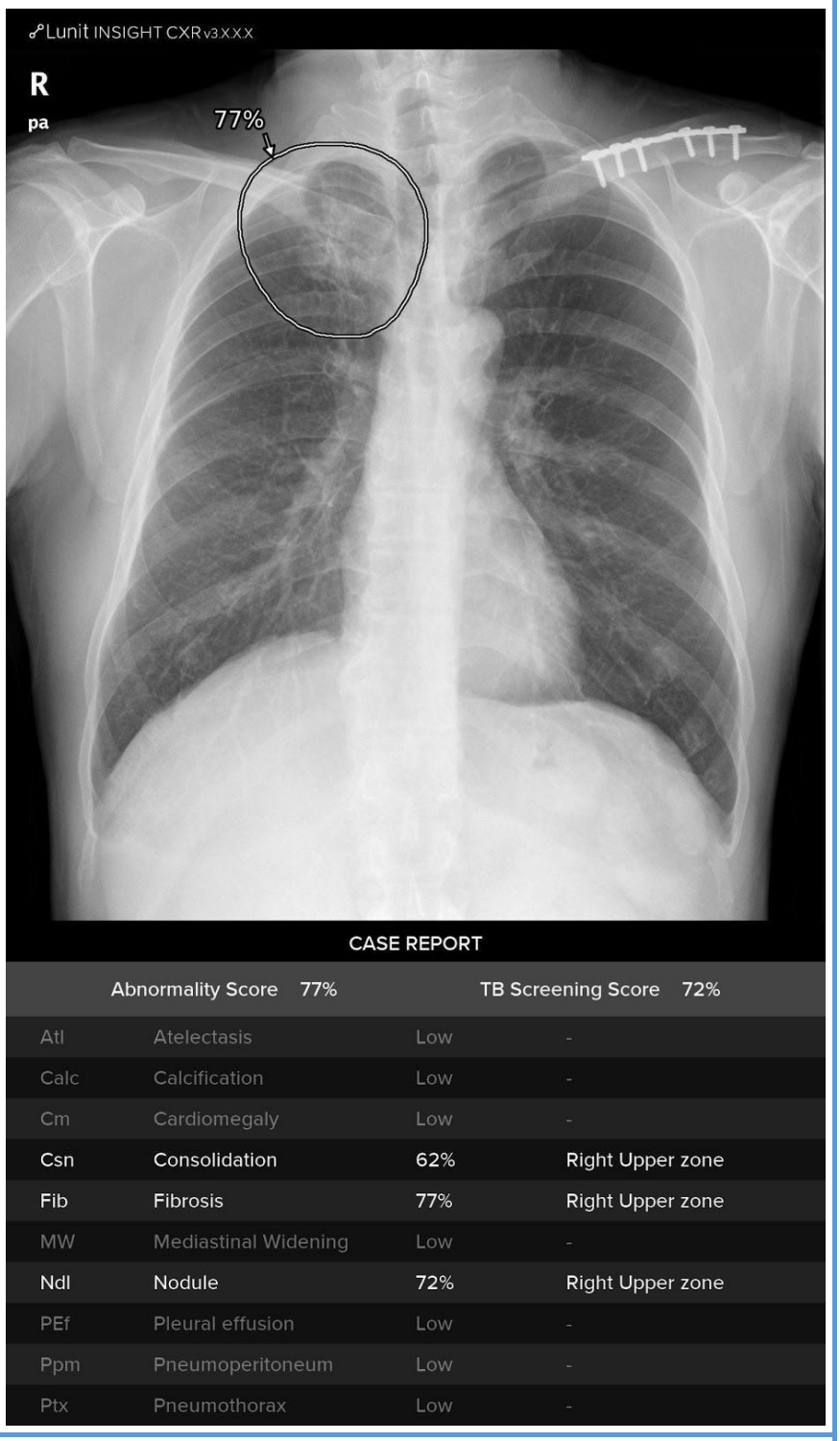
Product Profile: Lunit

Product	Lunit INSIGHT CXR
Company	Lunit
Company HQ	Seoul, South Korea
Product Version	V3.1.0.0
Website	https://lunit.io
Demo	https://insight.lunit.io
Last updated	April 17, 2020
Description	Lunit INSIGHT CXR is an AI solution which detects 10 different radiologic findings on chest x-rays including tuberculosis. It is designed to provide a quick analysis in hard-to-reach areas regardless of internet connections, with proven versatility among different x-ray devices. The AI solution generates (1) location information of detected lesions in color or outline, (2) abnormality scores reflecting the probability that the detected lesion is abnormal, and (3) an AI "case report" that summarizes the analysis result by each finding.
Certification	Stage of development: On the market Certification: CE-marked
Intended Age Group	14+ years (regulatory approval)
Target Setting	Primary health centres, General hospital (above primary level), Teleradiology companies, Government/public sector, e.g. national TB program, Private sector
Current Market	Asia-Pacific, Europe, Middle East/North Africa, North America, South/Central America
Input	Can be used to read images from any kind of chest X-ray machine (vendor neutral). Chest X-ray image format: DICOM Chest X-ray type: Posterior-anterior chest X-ray, Anterior-posterior chest X-ray, Portable Other requirements: It is required to upload an original image in the standard DICOM-format which contains appropriate DICOM metadata information in specific DICOM tags.
Output	Structured report that includes: ● Heat map ● Probability score as well as dichotomous output indicating for each abnormality whether this is present or absent. ● Probability score as well as dichotomous output indicating whether TB is likely present or likely absent, ● Specification of the location of each abnormality Default threshold probability score is set at 15% for all abnormalities including TB.

	Chest abnormalities detected by the product for which a separate abnormality score is given include: Atelectasis, Calcification, Cardiomegaly, Consolidation, Fibrosis, Mediastinal Widening, Nodule, Pleural Effusion, Pneumoperitoneum, Pneumothorax and TB. 
Deployment	Online and Offline
Hardware	Please contact insight@lunit.io for information.

Xray machine validation	Please contact insight@lunit.io for information.
Software	Please contact insight@lunit.io for information.
Server	Please contact insight@lunit.io for information.
Integration	Lunit INSIGHT CXR can be integrated with a legacy Picture Archiving and Communication System (PACS) which communicates via DICOM C-STORE.
Processing Time	About 20 seconds per one X-ray
Data Sharing & Privacy	
Server location (for online product)	Amazon Web Services is used. Local or national servers can be set up if required.
Data shared with manufacturer?	No
De-identification (option to deidentify?)	Yes. The Lunit DICOM Gateway anonymizes all personal information before transferring original images to the analysis server.
Software Updates	
Frequency	At least once a year.
Cost	Please contact insight@lunit.io for information.
Price	LUNIT INSIGHT offers volume-based pricing for the use of the license. When using the online solution, the volume-based price includes maintenance. When using the offline solution, maintenance is optional. Infrastructure fee, customization and consulting fee are subject to change depending on the operating environment.
Product Development	
Method	Supervised deep learning (CNN)
Training	Please contact insight@lunit.io for information. The product was trained on 200,000 chest X-rays.
Reference Standard	Please contact insight@lunit.io for the information. Chest CT, pathology reports with chest abnormalities and culture test result for tuberculosis.
Publications	1. Nam JG, Park S, Hwang EJ, Lee JH, Jin K-N, Lim KY, et al. Development and Validation of Deep Learning–based Automatic Detection Algorithm for Malignant Pulmonary Nodules on Chest Radiographs. Radiology [Internet]. 2019 Jan 1 [cited 2020 Apr 16];290(1):218–28. Available from: http://pubs.rsna.org/doi/10.1148/radiol.2018180237 2. Eui Jin Hwang, Sunggyun Park, et al. Development and Validation of a Deep Learning–based Automatic Detection Algorithm for Active Pulmonary Tuberculosis on Chest Radiographs | Clinical Infectious Diseases | Oxford Academic [Internet]. 2018 Nov [cited 2020 Apr 16]. Available from: https://academic.oup.com/cid/article/69/5/739/5174137

3. Hwang EJ, Park S, Jin KN, Kim JI, Choi SY, Lee JH, et al. Development and Validation of a Deep Learning-Based Automated Detection Algorithm for Major Thoracic Diseases on Chest Radiographs. JAMA Netw open. 2019 Mar 1;2(3):e191095. Available from: https://doi.org/10.1001/jamanetworkopen.2019.1095

4. Qin ZZ, Sander MS, Rai B, Titahong CN, Sudrungrot S, Laah SN, et al. Using artificial intelligence to read chest radiographs for tuberculosis detection: A multi-site evaluation of the diagnostic accuracy of three deep learning systems. Sci Rep. 2019 Dec 1;9(1):1–10. Available from: https://doi.org/10.1038/s41598-019-51503-3

5. Hwang EJ, Nam JG, Lim WH, Park SJ, Jeong YS, Kang JH, et al. Deep Learning for Chest Radiograph Diagnosis in the Emergency Department. Radiology [Internet]. 2019 Dec 22 [cited 2020 Apr 16];293(3):573–80. Available from: http://pubs.rsna.org/doi/10.1148/radiol.2019191225

6. Kim H, Park CM, Goo JM. Test-retest reproducibility of a deep learning–based automatic detection algorithm for the chest radiograph. Eur Radiol. 2020 Apr 1;30(4):2346–55. Available from: https://doi.org/10.1007/s00330-019-06589-8