VUNO Med-CXR Link

User Manual

Model No.: VN-M-02
Version No.: V1.3

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VUNO

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[Introduction]
VUNO Med-CXR Link is artificial intelligence (AI)-based diagnostic supporting solution for chest x-ray operating on Windows environment. It includes a DICOM detail setting menu and serves as a medium between servers that send and receive DICOM images through SCP and SCU communication. It receives a DICOM Image through SCP communication, analyzes the image through VUNO Med®-Chest X-ray™, and sends and stores the image to servers with PACS and SCP communication through SCU communication.

[Requirements]
Below are hardware and software requirements to operate CXR Link.

1. Requirements

Item	Content
Hardware	CPU: Intel Core i3/i5 8th or higher RAM: ≥8 GB
Software	Windows 10, 64bit

[Install and Uninstall CXR Link]
Below are requirements to operate CXR Link.

1. Prerequisites

1.1. Windows environment

- O/S: Windows 10, 64bit
- RAM: 8GB or higher

2. Install CXR Link

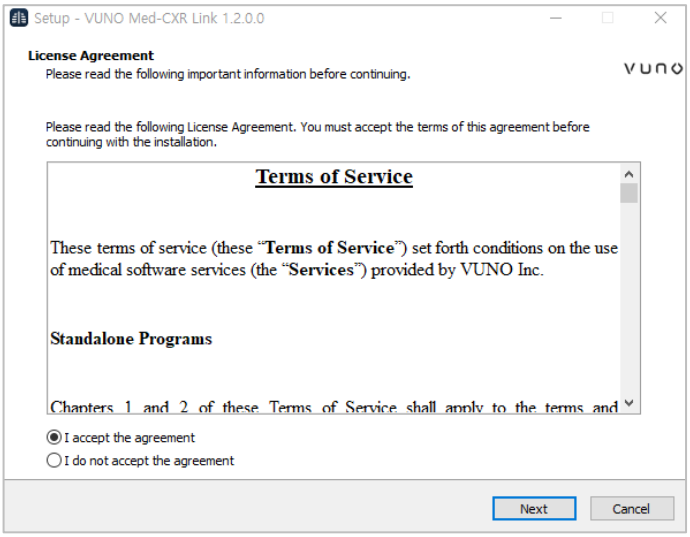
2.1. Execute ‘ VUNO Med-CXR Link-v1.3.0.x-Setup.exe’.

CAUTION

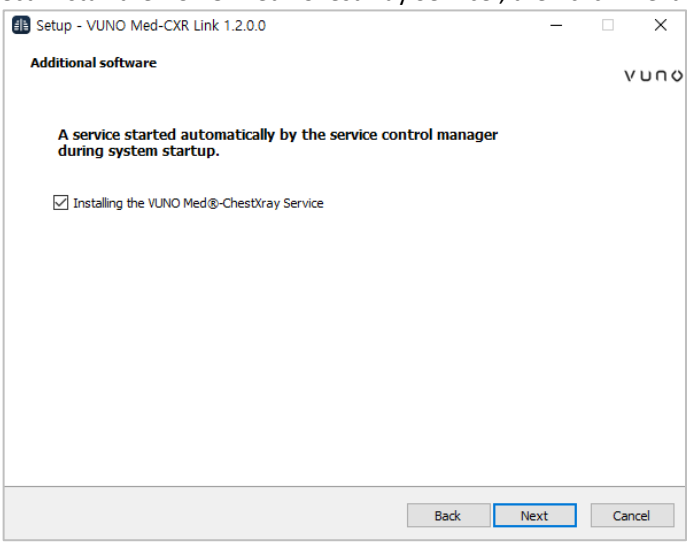
Before installing the program, the old program such as API, SDK, or CXR Link must be uninstalled.

2.2. Follow the instruction to install the program.

① Click ‘I accept the agreement’, then ‘Next’.



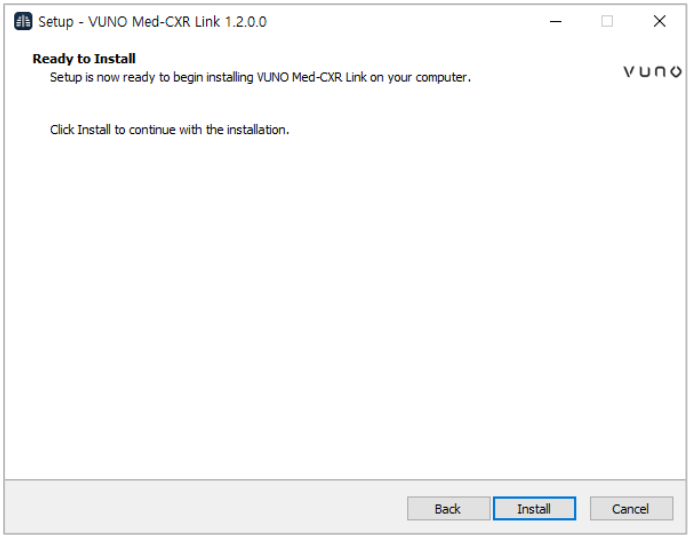
② Select ‘Install the VUNO Med®-ChestXray Service’, then click ‘Next’.

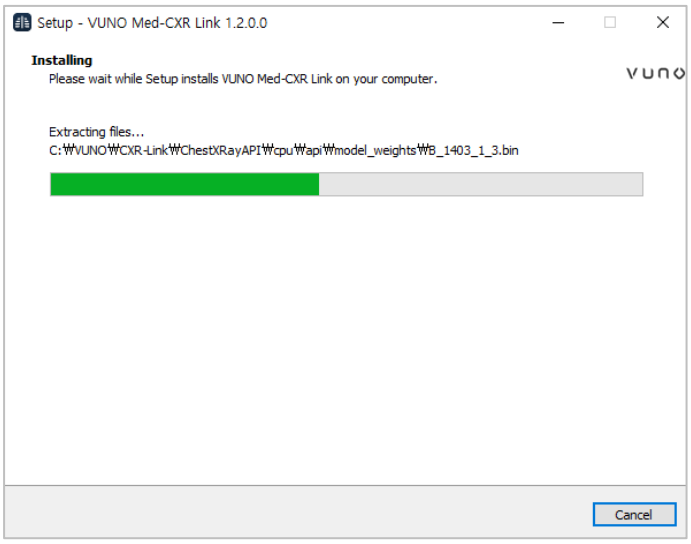


CAUTION

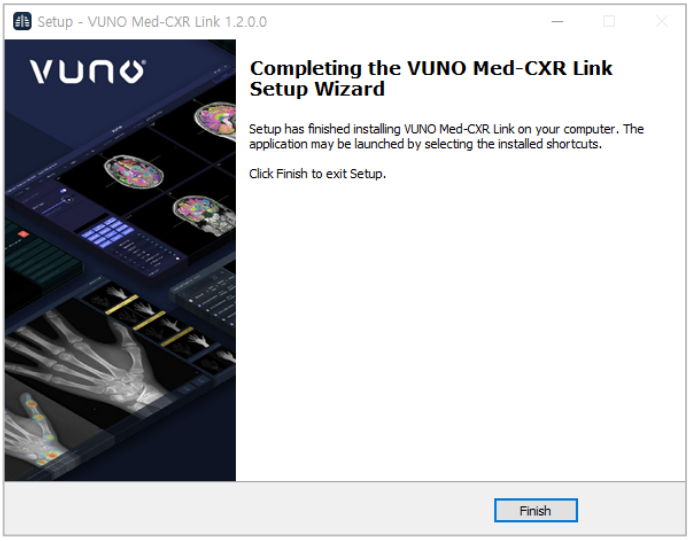
Before installing the program, select ‘Installing the VUNO Med®-Chest-Xray Service’ depending on user’s environment.
If ‘Installing the VUNO Med®-Chest-Xray Service’ is not selected, it would be installed as Viewer Mode. The Viewer Mode does not perform AI analysis of images. The images transferred from the SCP server are transferred to the SCU server.

③ Click ‘Install’ to execute installation.



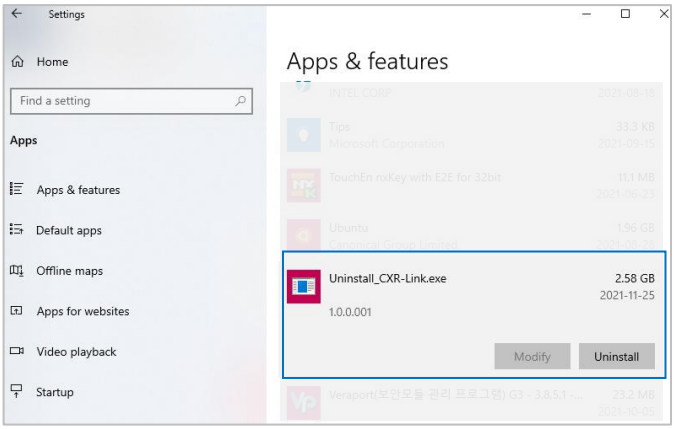


④ Click ‘Finish’ to complete the installation.



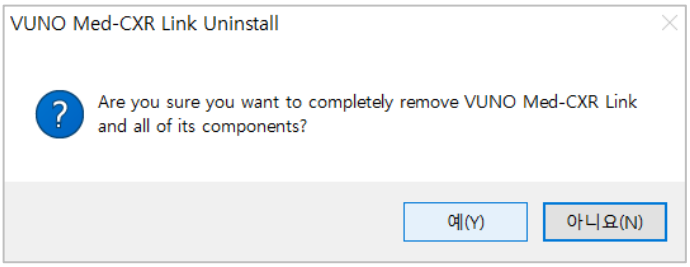
3. Uninstall CXR Link

3.1. Click ‘Uninstall VUNO Med-CXR Link’ in Windows > Settings > Apps > Apps & Features.

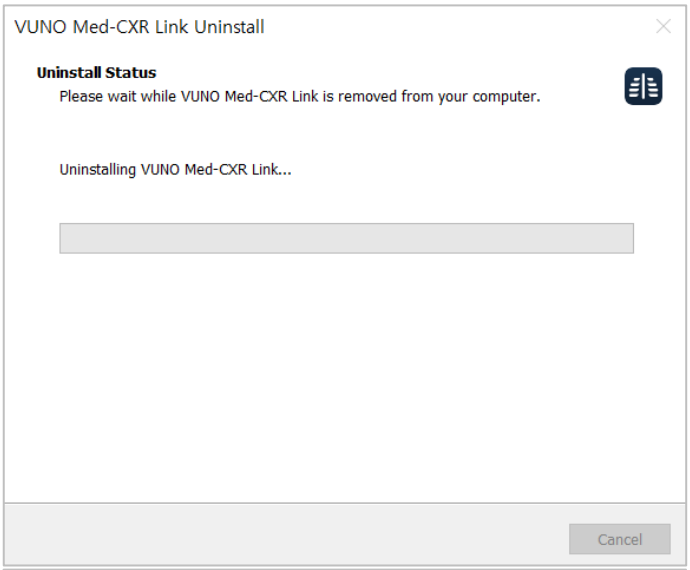


3.2. Follow the instruction to uninstall the program

① Once the below message is popped-up, Click '예(Y)'.



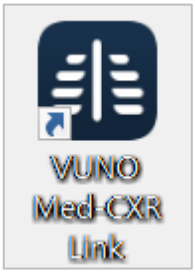
② Once the program is uninstalled, Click '확인(Confirm)'.



[How to run CXR Link]

1. How to run CXR Link

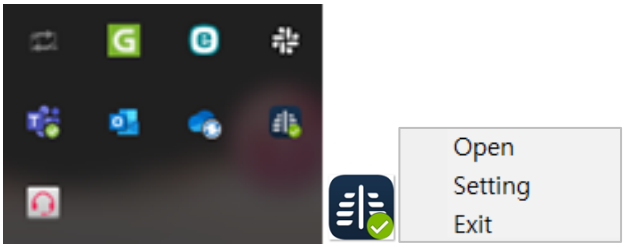
1.1. Desktop background



① Double-click ‘VUNO Med-CXR Link’ icon in Windows background.

② CXR Link will be executed.

1.2. Task bar



③ Click a tray icon on Windows taskbar.

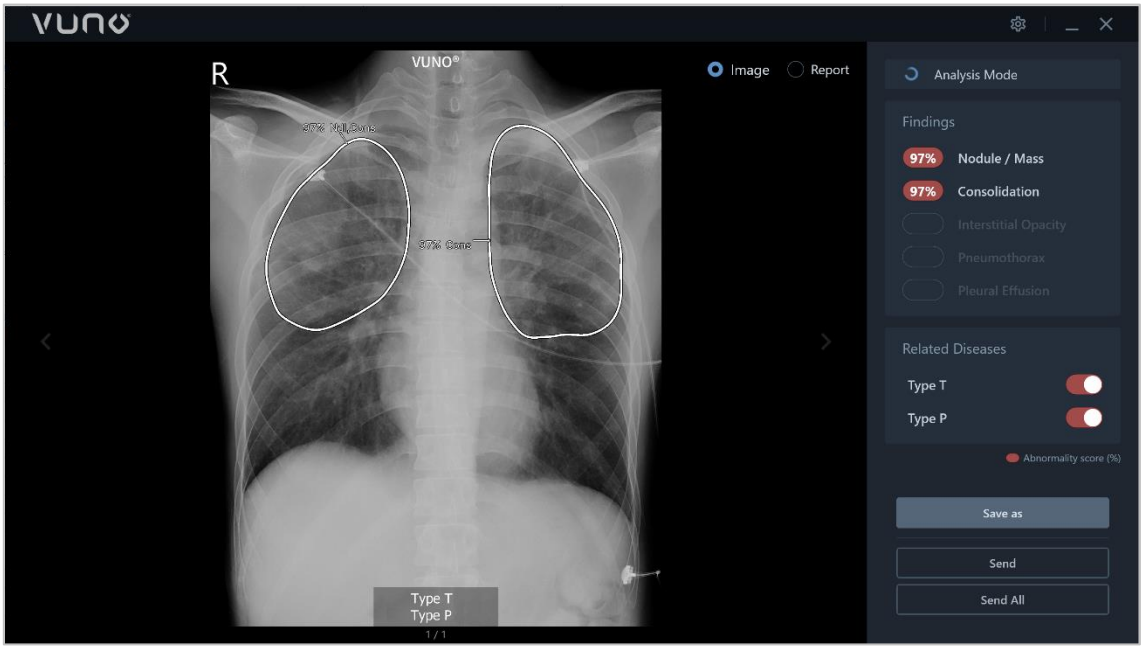
④ Click CXR Link icon, then right-click the icon.

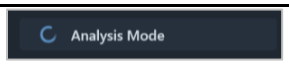
⑤ Click ‘Open’, then CXR Link will be executed.

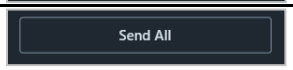
[Description of functionalities and management]

1. Analysis Screen

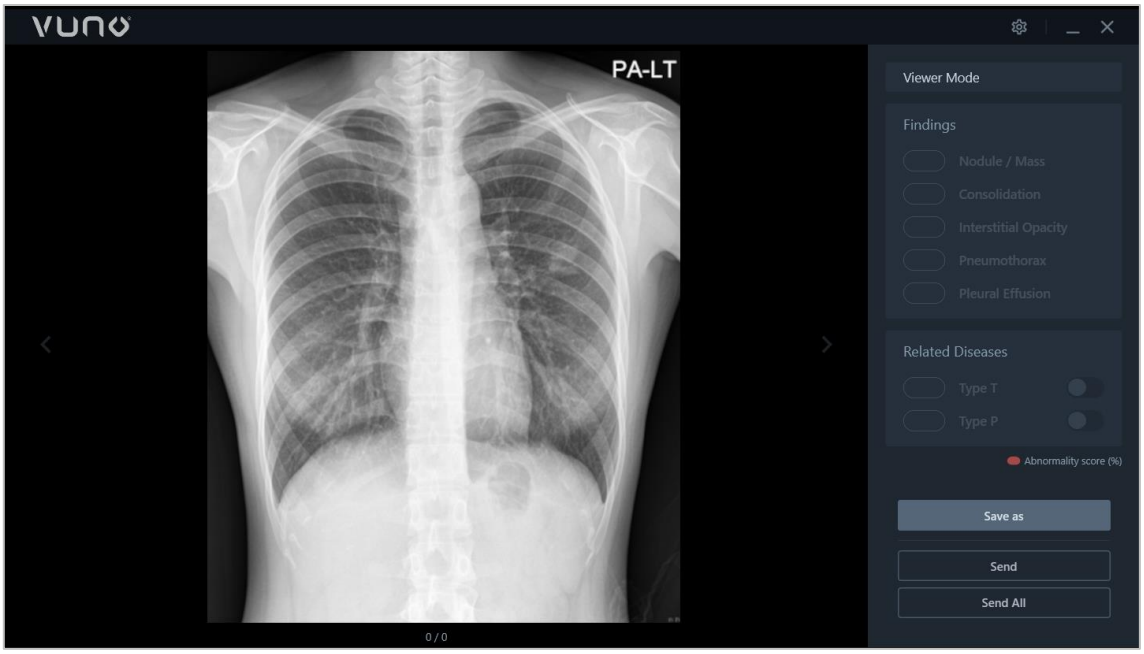
1.1. Analysis mode

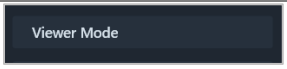


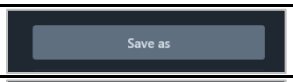
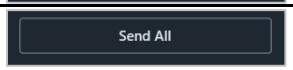
Functionality	Description
	A logo set by a user is displayed. **NOTE** Set the logo in Settings > My Page
	The mode user selected is displayed. While analyzing an image, an icon showcasing the progress appears. **NOTE** If 'Install the VUNO Med®-Chest X-ray Service' is selected, the program is installed in Analysis Mode. User can check whether AI analysis is possible depending on the mode.
	It shows lesions detected. The probability of lesions AI analyzed is displayed with Abnormality Score (%).
	Shows whether findings related to tuberculosis and pneumonia are present in the image. The user can accept or reject the results. ▪ Tuberculosis: Type T ▪ Pneumonia: Type P **NOTE** By default, the software considers nodules and consolidations to be findings related to tuberculosis, and consolidations or interstitial opacities to be findings related to pneumonia. (Refer to 2. Settings> 2.2 Options> Related Diseases)

	The user can select which format they want to save the results in when the analysis is completed. ▪ Image: Analyzed image ▪ Report: Result report
	A user can designate locations where the analyzed images are stored. Support formats: JPEG, PNG, BMP, DCM
	Once a user clicks 'Send', analyzed image is sent to PACS.
	Once a user clicks 'Send All', bulk images analyzed by AI is sent to PACS.
	Settings
	Minimize the application. CAUTION If the program is set as 'Pop-up Screen (on)' and the screen is minimized, the program would not be operated. (Refer to 2.2 Options> Pop-up Screen)
	Close the application

1.2. Viewer mode

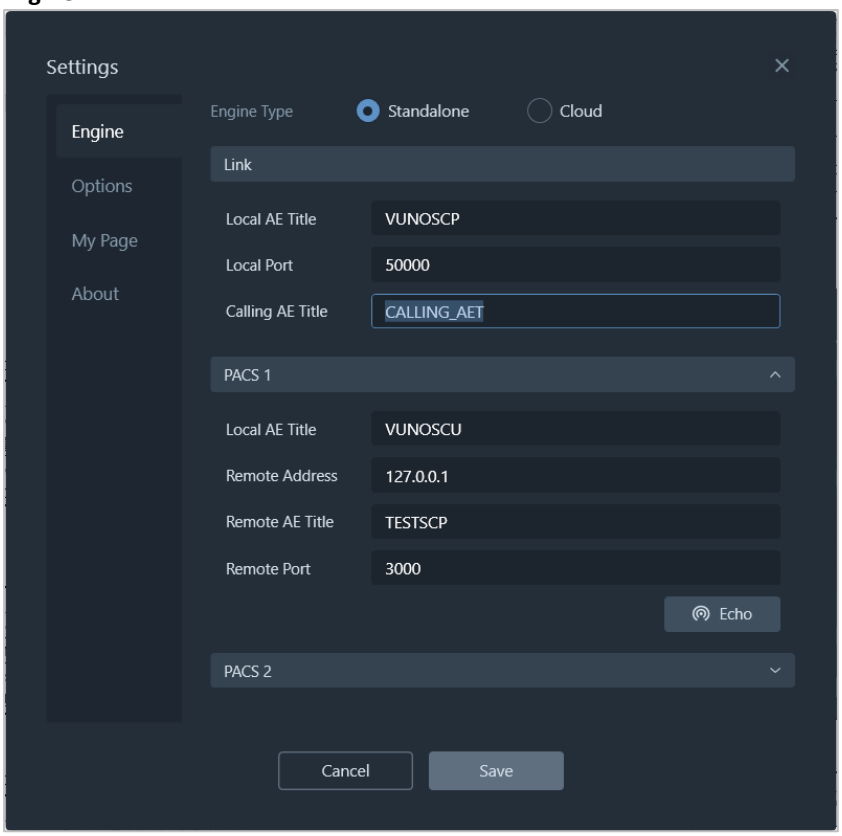


Functionality	Description
	A logo set by a user is displayed. **NOTE** Set the logo in Settings > My Page
	The mode user selected is displayed. **NOTE** If 'Install the VUNO Med®-Chest X-ray Service' is not selected, the program is installed as Viewer Mode.

	The Viewer Mode does not perform AI analysis of images.
	A user can designate locations where the analyzed images are stored. Support formats: JPEG, PNG, BMP, DCM
	Once a user clicks ‘Send’, analyzed image is sent to PACS.
	Once a user clicks ‘Send All’, bulk images analyzed by AI is sent to PACS.
	Settings
	Minimize the application
	Close the application

2. Settings

2.1. Engine



- **Engine Type**
  Select the type of AI.

Functionality	Description
Standalone	If VUNO Med-Chest X-ray Service is installed, select 'Standalone', then set up Link and PACS server.
Cloud	If VUNO Med-Chest X-ray Service is not installed, select 'Cloud', then set up Link, PACS and Cloud Server.

- **Link**
  Set up a SCP to receive DICOM images from third party systems. (PACS, Modality, etc.)

Functionality	Description
Local AE Title	Enter 'Application Entity (AE) title' of the local SCP server.
Local Port	Enter 'Port Number' that the local SCP server will use.
Calling AE Title	Enter 'Application Entity (AE) title' of the system sending the image. (The server will only accept images from systems using this, AE Title.)

- **PACS 1, PACS 2**
  Settings for sending analysis results. (PACS, RIS, etc.)

Functionality	Description
Local AE Title	Enter 'Application Entity (AE) title' of the server sending the image.
Remote Address	Enter 'IP address' of the server receiving the image.
Remote AE Title	Enter 'Application Entity (AE) title' of the server receiving the image.
Remote Port	Enter 'Port Number' of the server receiving the image.
Echo	Check the status of access to the Remote server.

NOTE

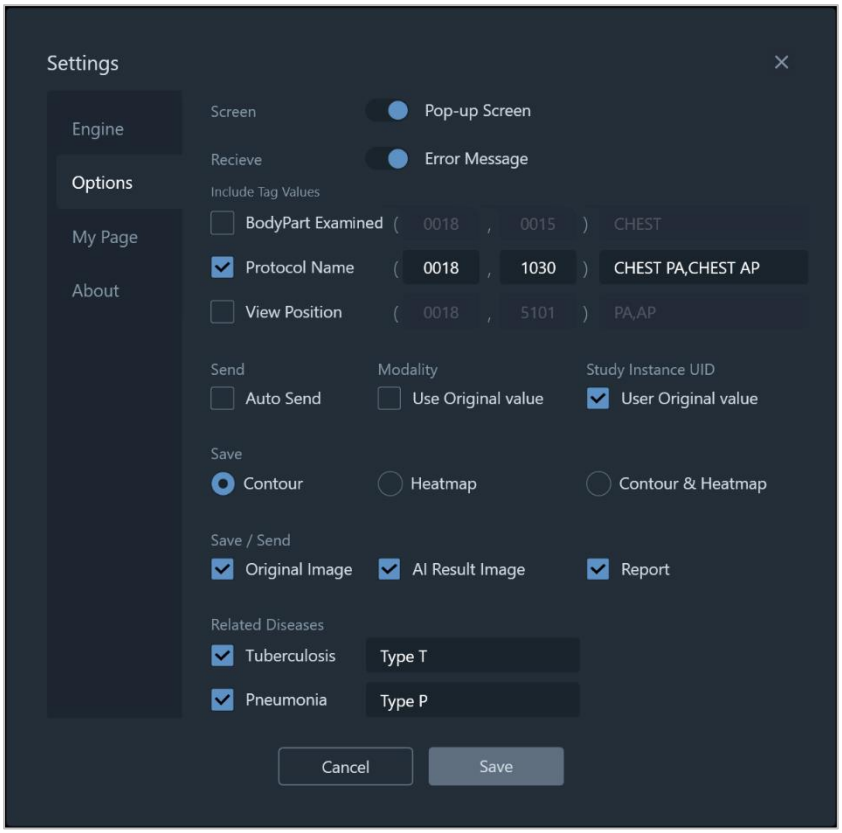
If a user selects PACS 1 and PACS 2, analyzed images would be sent to two servers.

- **Cloud**

Set up cloud service to request image analysis.

Functionality	Description
Base URL	Enter the address of the Standalone or Cloud server.
E-mail	Enter the email address used to access the Cloud server.
Password	Enter the password used to access the Cloud server.
Check	Confirm if the E-mail account and Password are correct.

2.2. Options



- **Pop-up Screen**

Set whether to display the result on the user's screen when the analysis is completed.

Functionality	Description
On	When the analysis is completed, the application displays the analysis results. **CAUTION** If the application is running and minimized, it will not pop-up automatically.
Off	When the analysis is completed, it does not start the application.

- **Receive**

  Set whether to notify error information of the receiving image.

Functionality	Description
Error Message	When an error occurs while analyzing an image, error information is displayed with a pop-up screen. Click the check box. **NOTE** When an error occurs, its information is always recorded in the log. (C:\VUNO\CXR-Link\CXRLink\Log)

- **Include Tag Values**

  By filtering DICOM tags of the receiving image, the user can receive specified image.

Functionality	Description
Body Part Examined	Process images with matching Body Part Examined (0018,0015) tag
Protocol Name	Process images with matching Protocol Name (0018,1030) tag
View Position	Process images with matching View Position (0018,5101) tag

NOTE

To change what values should be present in the DICOM tags, click and edit the value.

- **Send**

  Automatically send result image to the designated server.

Functionality	Description
Auto	Without checking a 'Send/Send All' box, result image would be automatically sent to the designated server.

- **Modality**

  Edit modality tag of the result image.

Functionality	Description
User Original Value	The modality (0008,0060) information of the result image is displayed the same value of the original image. If this option is not selected, the modality information of the resulting image will be set as 'OT'. Result image would receive the Modality's value in DICOM tags of the original DICOM file. Click the check box to change the setting.

- **Study Instance UID**

  Change Study Instance UID and Accession Number of the result image.

Functionality	Description
User Original Value	The Study Instance UID (0020,000D) and Accession Number (0008,0050) information of the result image is displayed the same value of the original image. If this option is not selected, random values will be inserted in the Study Instance UID and Accession Number information in the resulting image. Click the check box to change the setting. **CAUTION** If the study instance UID and accession number are different from the original image, another study separated from original study will be created.

- **ROI**

  Select a method of drawing the detected lesion when the case is abnormal.

Functionality	Description
Contour	It draws the detected lesion with Contour line.
Heatmap	It draws the detected lesion with Heatmap (colored).
Contour & Heatmap	It draws the detected lesion with Contour line and Heatmap.

- **Save/Send**

  Select outputs to be sent to PACS after AI analysis.

Functionality	Description
Original Image	It sends an original image.
AI Result Image	It sends an AI analysis result image.
Report	It sends analyzed result in the format of a report.

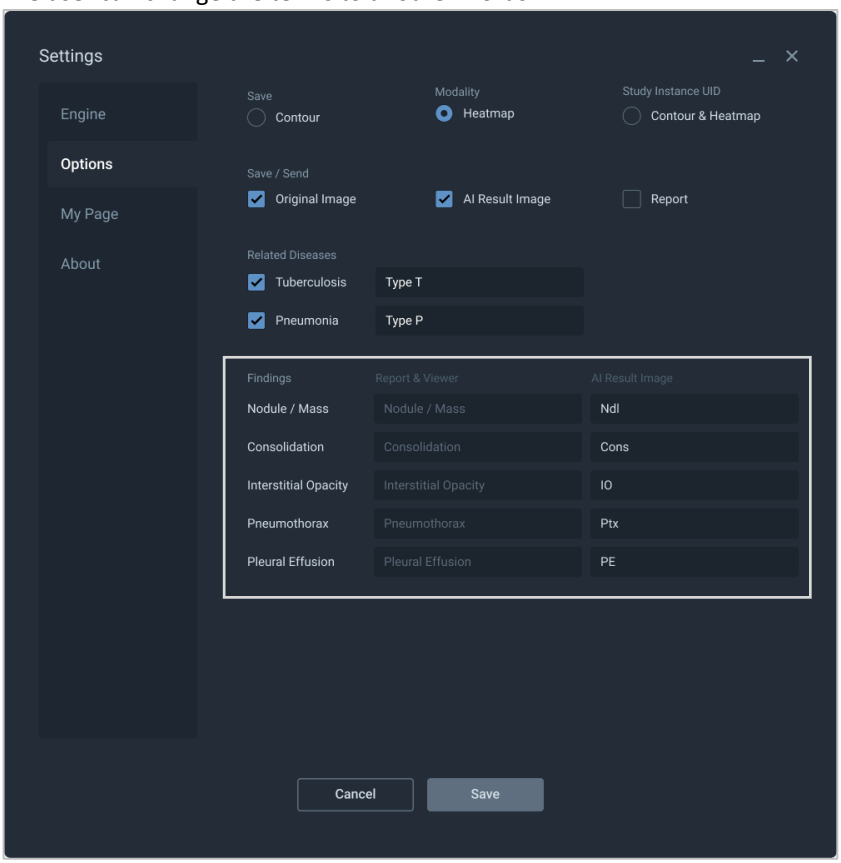
- **Related Diseases**

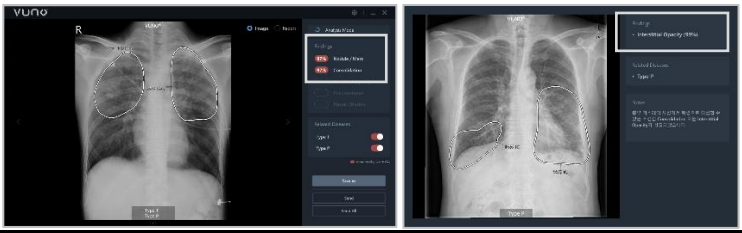
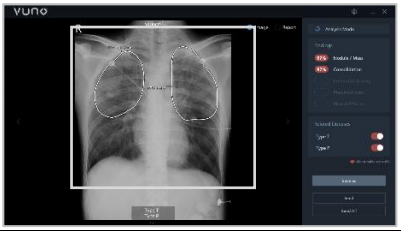
  Select whether tuberculosis and pneumonia should be displayed in the results. When related findings are present in processed images, selected diseases will be displayed on the report.

Functionality	Description
Tuberculosis	Select whether tuberculosis should be screened. When nodules or consolidations, known to be related to tuberculosis, are detected, Type T is displayed in Related Disease on screen. ▪ The user can the function on/off. ▪ The user can change the term 'Type T' to another word.
Pneumonia	Select whether tuberculosis should be screened. When consolidations or interstitial opacities, known to be related to pneumonia, are detected, Type P is displayed in Related Disease on screen. ▪ The user can turn the function on/off. ▪ The user can change the term 'Type P' to another word.

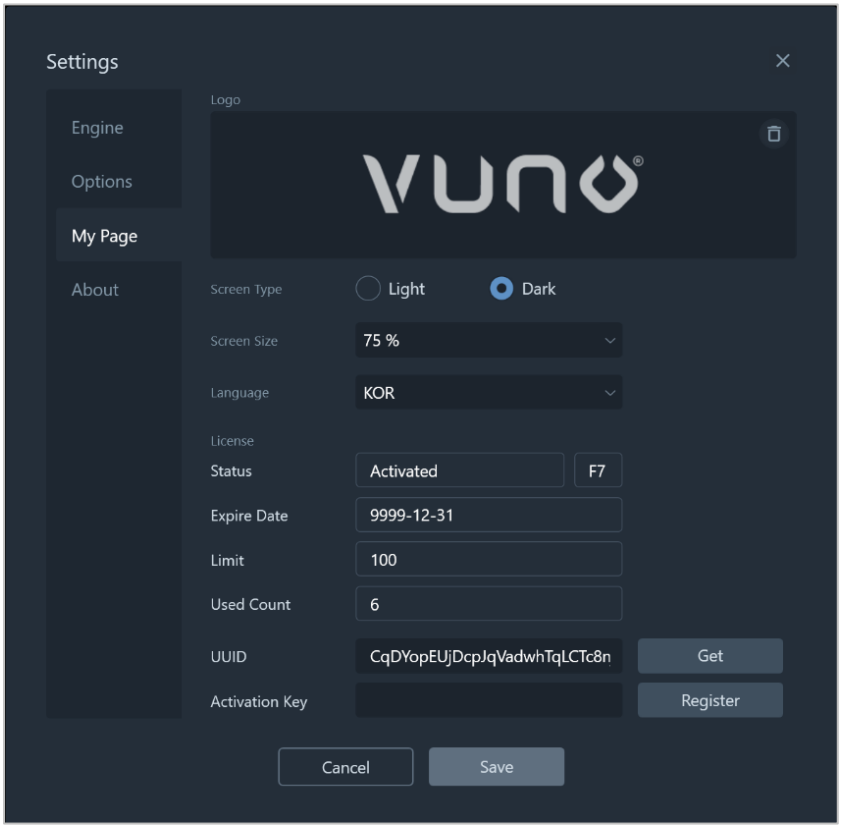
- **Findings**

  The user can change the terms to another words.



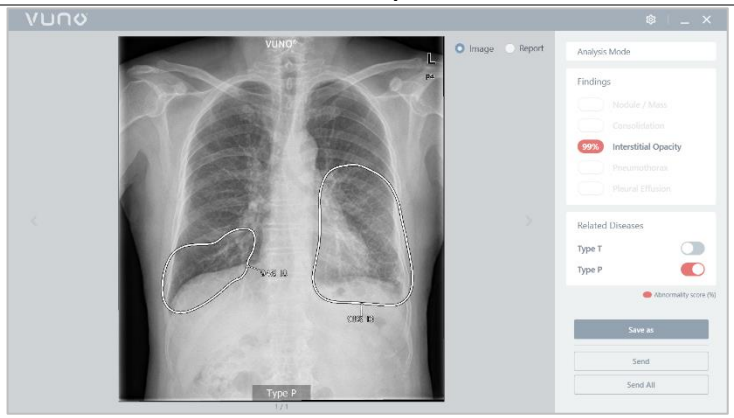
Functionality	Description
Report & Viewer	Change the words and press Save. ▪ The Findings terms are changed in the Viewer screen. ▪ The Findings terms are changed in the Report screen. 
AI Result Image	Change the words and press Save. ▪ The result terms(abbreviation) are changed in the AI Result Image. 

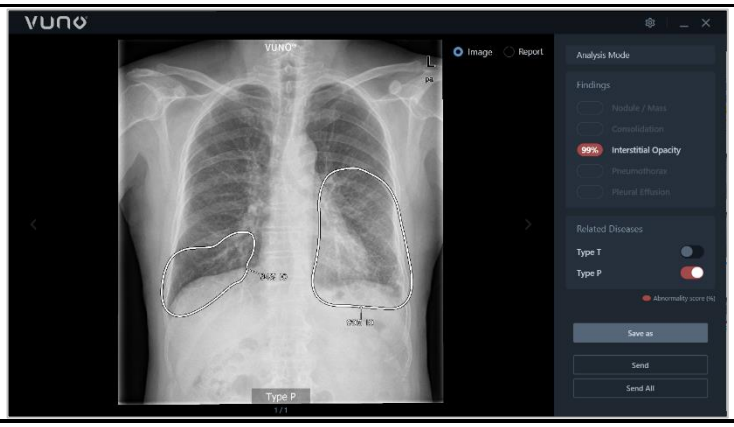
2.3. My Page



- **Logo**
  Set user's logo.

- **Screen Type**
  Set the type of UI.

Functionality	Description
Light	

Dark	

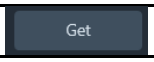
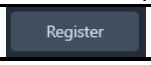
- **Screen Size**
  Set screen size to suit user's environment.

Functionality	Description
Full	Full screen
75%	75% of the monitor (Default setting)
50%	50% of the monitor

- **Language**
  Set the language.

Functionality	Description
KOR	The language is set as Korean and Korean report including MFDS label is provided.
ENG	The language is set as English and English report including CE label is provided.

- **License**
  Provide user's license information to proceed AI analysis.

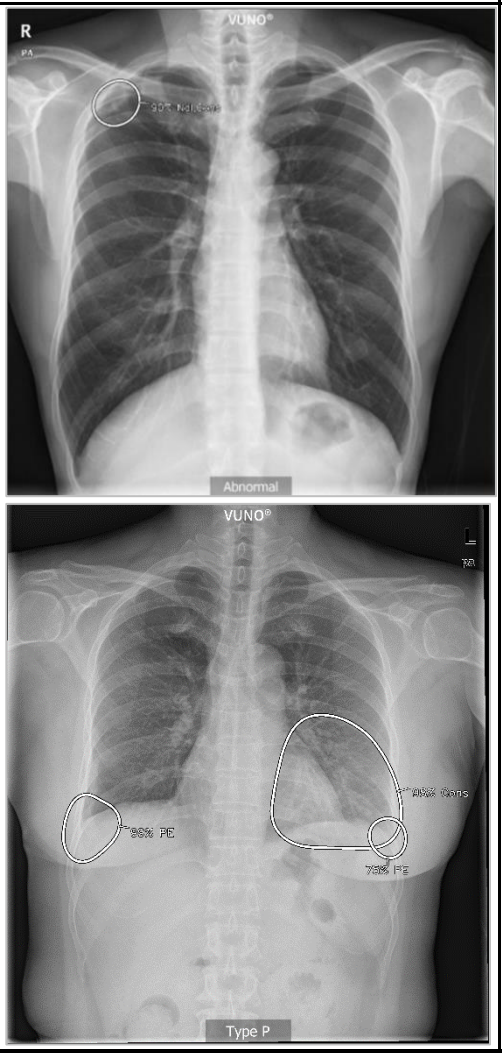
Functionality	Description
Status	Whether the registered license is available
	The number of findings available for the registered license. (F7, F5, or F2)
Expire Date	License expiration date
Limit	The total number of credits
Used Count	The number of used credits
UUID	HW key information to issue a license
	To get a unique HW key
Activation key	To register a newly issued license
	To register a newly issued license

[Analyzed result]

1. Analyzed result and report

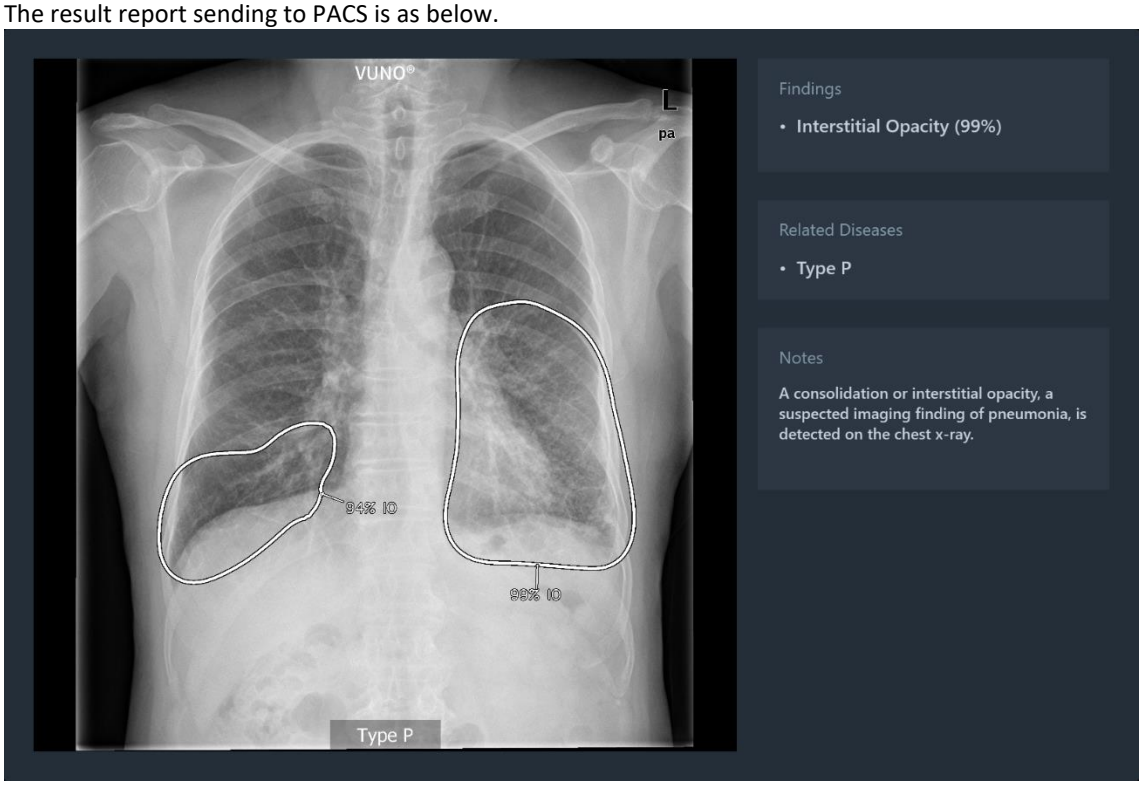
1.1. Result image

After analyzing an image, the result image is sent to PACS as below.

Result image	Description
	① ROI: Depending on the setting, the detected lesion is indicated with Contour, Heatmap, or Contour+Heatmap. ② Findings: The abbreviation of findings is indicated. - Ndl: Nodule - Cons: Consolidation - IO: Interstitial Opacity - Ptx: Pneumothorax - PE: Pleural Effusion ③ Abnormality Score (%): The probability of the detection is displayed as %. ④ No Findings/Abnormal: If there are no findings, “No Findings” is displayed at the bottom of the image. If there is at least one finding, “Abnormal” is displayed at the bottom of the image. ⑤ Related Diseases: When the functionalities to screen tuberculosis and pneumonia are activated and related findings are detected, Type T or Type P would be displayed at the bottom of the image.

1.2. Report

The result report sending to PACS is as below.



- **Findings**
  It displays detected lesions and its Abnormality Score (%).

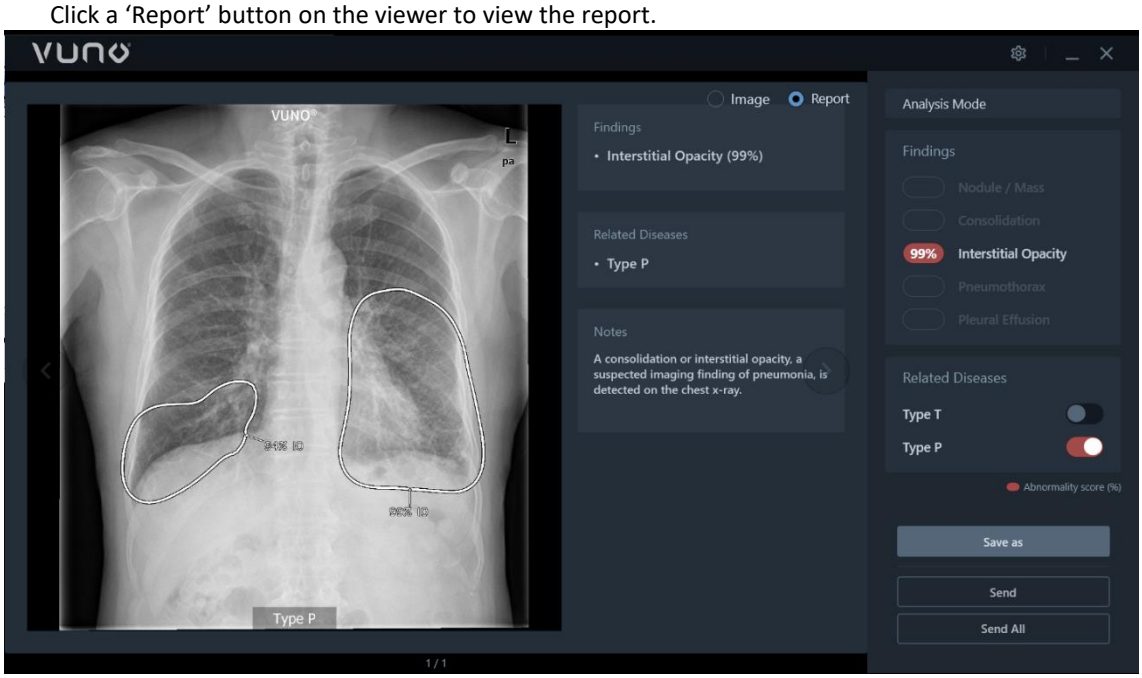
- **Related Diseases**
  When the functionalities to screen tuberculosis and pneumonia are activated, the analyzed result whether the case is suspected of tuberculosis (Type T) or pneumonia (Type P) will be displayed.

- **Notes**
  The below table includes explanation of findings related to tuberculosis and pneumonia.

Related Diseases	Description
Tuberculosis	A nodule or consolidation, a suspected finding of tuberculosis, is detected on the chest x-ray.
Pneumonia	A consolidation or interstitial opacity, a suspected finding of pneumonia, is detected on the chest x-ray.

1.3. View report

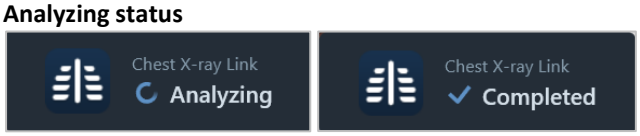
Click a ‘Report’ button on the viewer to view the report.



CAUTION

The report is provided only when there is detected abnormality. If there is no finding, the report and the ‘Report’ button on the viewer will not be provided.

1.4. Analyzing status



- **Analyzing**
  When the image analysis is started, an ‘Analyzing’ message appears.

- **Completed**
  Once the image analysis is completed, a ‘Completed’ message appears and the results are sent to PACS.

[Precautions]

1. Warning

1) The analyzed results provided by the software requires user's final decision.
2) The software is a reference program for assisting the diagnosis of medical personnel. It is not possible to exclude the possibility of misdiagnosis if it makes a decision that can affect the health of the patient such as diagnosis, treatment and so on.
3) The user is responsible for the final diagnosis decision referring to the software.

2. General Precautions

[Performance related Precautions]

1) The person having medical knowledge about the correct use of the device reads the manual before use and use the software.
2) It does not guarantee analytical performance for people under the age of 19.
3) It is applied to digital radiographs taken in the posterior-anterior view (PA), anterior-posterior view (AP) and does not guarantee analytical performance for other inappropriate images such as lateral view image and cropped image.
4) The product was developed with approximately 50,000 data collected from two tertiary hospitals and can detect five major abnormalities (Nodule / Mass, Consolidation, Interstitial opacity, Pleural effusion, and Pneumothorax).
5) "Abnormal" in this product does not include all abnormal findings found on chest radiograph. Pulmonary diseases may exist even if no abnormality is found in the case analyzed by the product. It does not guarantee the performance of abnormalities other than those supported by the product.
6) The test performance of this product is sensitivity 80% or higher, false positivity 1.5 or less per one x-ray image. However, the performance is derived from a limited data set, and the actual performance may vary depending on the data set configuration.

[General Precautions]

1) When storing or loading data, do not shut down software or power off PC.
2) Identify the patient's ID so that the wrong patient image is not used before reading the image.
3) DICOM format may require time for storing or retrieving image. When a PC performs a task, it may slow down the PC to perform another task.
4) Analysis result may vary depending on the format or resolution of the image to be loaded and the shooting environment.
5) When hard disk capacity is insufficient, all data cannot be saved. If the remaining capacity is less than 1 GB, you will not be able to save any more data, so you should check the capacity before saving the image
6) If you do not install security control on the PC where this software is installed, or if there is a risk of malicious code penetration on the network, the PC may be infected with malicious code (malicious software such as virus or worm for computer)
7) Since the server requires only one LAN port to run the software, it is recommended to block other physical ports such as communication port and USB except for one LAN port with LAN port lock and USB port lock and turn off all wireless connection settings such as Bluetooth.
8) When using the product, it is necessary to comply with regulations related to medicine and personal information.
9) If any issue related to the product occurs, please notify the manufacturer (including cybersecurity incident)
Tel: 02-515-6646 / E-mail: customer@vuno.co

※ **The product is medical device.**