# **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<sup>®</sup>-Chest X-ray<sup>™</sup>, 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

ltem	Content
Hardware	CPU: Intel Core i3/i5 8 <sup>th</sup> 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'.

Setup - VUNO Med-CXR Link 1.2.0.0		×
License Agreement		VUOO
Please read the following important information before continuing.		0000
Please read the following License Agreement. You must accept the terms of this agreement before continuing with the installation.	re	
Terms of Service		^
These terms of service (these "Terms of Service") set forth conditions on t	he use	
of medical software services (the "Services") provided by VUNO Inc.		
Standalone Programs		
Chapters 1 and 2 of these Terms of Service shall apply to the term	s and	~
<ul> <li>I accept the agreement</li> </ul>		
○ I do not accept the agreement		
Next	(	Cancel

② Select 'Install the VUNO Med<sup>®</sup>-ChestXray Service', then click 'Next'.

B Setup - VUNO Med-CXR Link 1.2.0.0		_		×
Additional software			v	UNO
A service started automatically by the service con during system startup.	trol manager			
Installing the VUNO Med®-ChestXray Service				
	Back	Next	Can	cel



#### CAUTION

Before installing the program, select 'Installing the VUNO Med®-Chest-Xray Service' depending on user's environment.

If 'Installing the VUNO Med<sup>\*</sup>-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.

B Setup - VUNO Med-CXR Link 1.2.0.0	-		×
Ready to Install Setup is now ready to begin installing VUNO Med-CXR Link on your computer.		١	/uno
Click Install to continue with the installation.			
Back Inst	all	Car	ncel

Setup - VUNO Med-CXR Link 1.2.0.0	-		×
T			
Installing		V	1100
Please wait while Setup installs VUNO Med-CXR Link on your computer.		v	0.10
Extraction files			
C:\VUNO\CXR-Link\ChestXRavAPI\cou\arrowani\model weights\B 1403 1 3.bin			
			_
		Can	cel

④ Click 'Finish' to complete the installation.

🚯 Setup - VUNO Med-CXR Link 1.2.	0.0 — 🗆 ×
VUNO	Completing the VUNO Med-CXR Link Setup has finished installing VUNO Med-CXR Link on your computer. The application may be launched by selecting the installed shortcuts. Click Finish to exit Setup.
	Finish

#### 3. Uninstall CXR Link

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

4	Settings		
ŵ	Home	Apps & features	
Fi	nd a setting	INTEL CORP	
App	25		
E	Apps & features		
5	Default apps		
ц	Offline maps	Uninstall_CXR-Link.exe	2.58 GB
Lt.	Apps for websites	1.0.0.001	2021-11-25
⊐¤	Video playback	N	Aodify Uninstall
₽	Startup	Veraport(보안모들 관리 프로그램) G3	3 - 3.8,5,1 23.2 MB 2021-10-05

#### 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)'.

VUNO Med-CXR Link Uninstall	$\times$
Uninstall Status Please wait while VUNO Med-CXR Link is removed from your computer.	ł
Uninstalling VUNO Med-CXR Link	
Cance	1
VUNO Med-CXR Link Uninstall	×
VUNO Med-CXR Link was successfully removed from your computer.	
확인	

# [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





Functionality	Description	
VUNØ	A logo set by a user is displayed.	
	NOTE Set the logo in Settings > My Page	
C Analysis Mode	The mode user selected is displayed. While analyzing an image, an icon showcasing the progress appears. NOTE If 'Install the VUNO Med <sup>®</sup> -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.	
Findings 97% Nodule / Mass 97% Consolidation Interstitial Opacity Pneumothorax Pleural Effusion	It shows lesions detected. The probability of lesions AI analyzed is displayed with Abnormality Score (%).	
Related Diseases	<ul> <li>Shows whether findings related to tuberculosis and pneumonia are present in the image. The user can accept or reject the results.</li> <li>Tuberculosis: Type T</li> <li>Pneumonia: Type P</li> </ul>	
	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)	

• Image	The user can select which format they want to save the results in when the analysis is completed.     Image: Analyzed image     Report: Result report
Save as	A user can designate locations where the analyzed images are stored. Support formats: JPEG, PNG, BMP, DCM
Send	Once a user clicks 'Send', analyzed image is sent to PACS.
Send All	Once a user clicks 'Send All', bulk images analyzed by AI is sent to PACS.
段	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

VUUQ	\$\$ _ X
PA-LT	Viewer Mode
A DECEMBER OF THE OWNER OWNER OF THE OWNER OF THE OWNER OF THE OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNE OWNE OWNER OWNER OWNER OWNER OWNE OWNER OWNE OWNER OWNE OWNER OWNER OWNER OWNER OWNER OWNE OWNE OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNE OWNER OWNER OWNER OWNER OWNER O	
Marine Contraction	Abnormality score (%)
	Save as
	Send
	Send All
0/0	

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

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

# 2. Settings

# 2.1. Engine

Settings	Engine Type	Standalone	Cloud	×
Engine		Standalone		
Options	Link			
My Page	Local AE Title	VUNOSCP		
About	Local Port	50000		
	Calling AE Title	CALLING_AET		
	PACS 1			
	Local AE Title	VUNOSCU		
	Remote Address	127.0.0.1		
	Remote AE Title	TESTSCP		
	Remote Port	3000		
				lecho 🔊
	PACS 2			
	Cance	el Sav	e	

# 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

Settings		×
Engine	Screen Pop-up Screen	
Options	Recieve Error Message Include Tag Values	
My Page	BodyPart Examined ( 0018 , 0015 ) CHEST	
About	Protocol Name ( 0018 , 1030 ) CHEST PA,CHEST AP	
About	View Position ( 0018 , 5101 ) PA,AP	
	Send Modality Study Instance UID Auto Send Use Original value Viser Original value	
	Save Contour Heatmap Contour & Heatmap	
	Save / Send       Save / Send       Original Image       Al Result Image       Report	
	Tuberculosis Type T	
	Pneumonia Type P	
	Cancel Save	

# 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.	
	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.
	ΝΟΤΕ
	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

$\mathcal{D}$	
-	

# 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.
	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.
	<ul> <li>The user can the function on/off.</li> </ul>
	<ul> <li>The user can change the term 'Type T' to another word.</li> </ul>
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.
	<ul> <li>The user can turn the function on/off.</li> </ul>
	<ul> <li>The user can change the term 'Type P' to another word.</li> </ul>

# Findings

The user can change the terms to another words.

Settings			- ^	
Engine	Save Contour	Modality <ul> <li>Heatmap</li> </ul>	Study Instance UID Contour & Heatmap	
Options	Save / Send			
My Page	Original Image	🖌 Al Result Image	Report	
About				
About	Tuberculosis Ty	pe T		
	Pneumonia Typ	pe P		
	Findings Repo	ort & Viewer	Al Result Image	
	Nodule / Mass No		Ndl	
	Interstitial Opacity		10	
	Pneumothorax Pne		Ptx	
	Pleural Effusion Ple		PE	
	Cancel	Save		
Functionality	Cancel	Save	Description	
Functionality Report & Viewer	Cancel Change the	Save	Description ress Save.	
Functionality Report & Viewer	Cancel Change the	save e words and p e Findings ter	<b>Description</b> ress Save. ms are changed in th	ne Viewer scree
Functionality Report & Viewer	Cancel Change the Th Th	e words and p the Findings ter the Findings ter	<b>Description</b> ress Save. ms are changed in th ms are changed in th	ne Viewer scree ne Report scree
Functionality Report & Viewer	Cancel Change the • Th • Th	save e words and p the Findings ter the Findings ter	Description ress Save. ms are changed in th ms are changed in th imit of the second se	ne Viewer scree ne Report scree
Functionality Report & Viewer Al Result Image	Cancel Change the • Th • Th • Th • Th • Th • Th • Th • Th	save e words and p the Findings ter the Findings ter the Findings ter	Description ress Save. ms are changed in th ms are changed in th TIME TO THE TO THE TO THE TOT THE TOT THE TO THE TOT THE TOT THE TOT THE TO THE TOT THE TOT	ne Viewer scree ne Report scree
Functionality Report & Viewer	Cancel Change the Th Th Th Change the Change the Change the Th	save e words and p he Findings ter he Findings ter ter words and p he result terms	Description ress Save. ms are changed in th ms are changed in th ims are changed in th ims are changed in th ress Save. (abbreviation) are ch	ne Viewer scree ne Report scree Internet in the All
Functionality Report & Viewer	Cancel Change the Th Th Th Vunc R Change the Th Re	save e words and p he Findings ter the Findings ter the Findings ter the words and p he words and p he result terms esult Image.	Description ress Save. ms are changed in th ms are changed in th ims are changed in th ims are changed in th ims are changed in th ress Save. (abbreviation) are ch	ne Viewer scree ne Report scree The Report scree anged in the A

# 2.3. My Page

Settings				
				Ō
Options		VUN		
My Page				
About		Light Oark		
		75 %		
		KOR		
	Status	Activated	<b>F7</b>	
	Expire Date	9999-12-31		
	Limit	100		
	Used Count	6		
	UUID	CqDYopEUjDcpJqVadwhTq	LCTc8n	Get
	Activation Key			Register
	Can	cel Save		

- Logo Set user's logo.
- Screen Type Set the type of UI.

Functionality	Description	
Light	νυησ	© _ ×
		port Analysis Made Findings Badder / Made Consolidation Consolidation Findings Findi

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.

oce 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
<b>F7</b>	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
Get	To get a unique HW key
Activation key	To register a newly issued license
Register	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
	<ol> <li>ROI: Depending on the setting, the detected lesion is indicated with Contour, Heatmap, or Contour+Heatmap.</li> </ol>
	<ol> <li>Findings: The abbreviation of findings is indicated.</li> </ol>
	- Ndl: Nodule
	- Cons: Consolidation
	- IO: Interstitial Opacity
	- Ptx: Pneumothorax
	- PE: Pleural Effusion
	③ Abnormality Score (%): The probability of the detection is displayed as %.
Abnomat VUNO®	<ul> <li>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.</li> </ul>
	(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.
75% FZ	

#### 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: <a href="mailto:customer@vuno.co">customer@vuno.co</a>

#### **※** The product is medical device.