X-Ray to DICOM Converter

User Manual

Version 1.0.0

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Table of Contents

1. Introduction

The X-Ray to DICOM Converter is a Windows application that can convert live x-ray images from the CyberKnife treatment delivery system into DICOM format for use in QA tools, or simply for exporting them to PACS or viewing them in a compatible DICOM viewer. The application also supports conversion to DICOM from standard image types such as JPEG, BMP, TIFF, IMG, and PNG.

Once images are converted, the application provides a built-in Image Viewer that allows users to inspect both the original source images and the resulting DICOM files before or after export. Converted files can be sent directly to a remote DICOM SCP (e.g., a PACS system or Orthanc server) using the integrated C-STORE export feature.

2. System Requirements

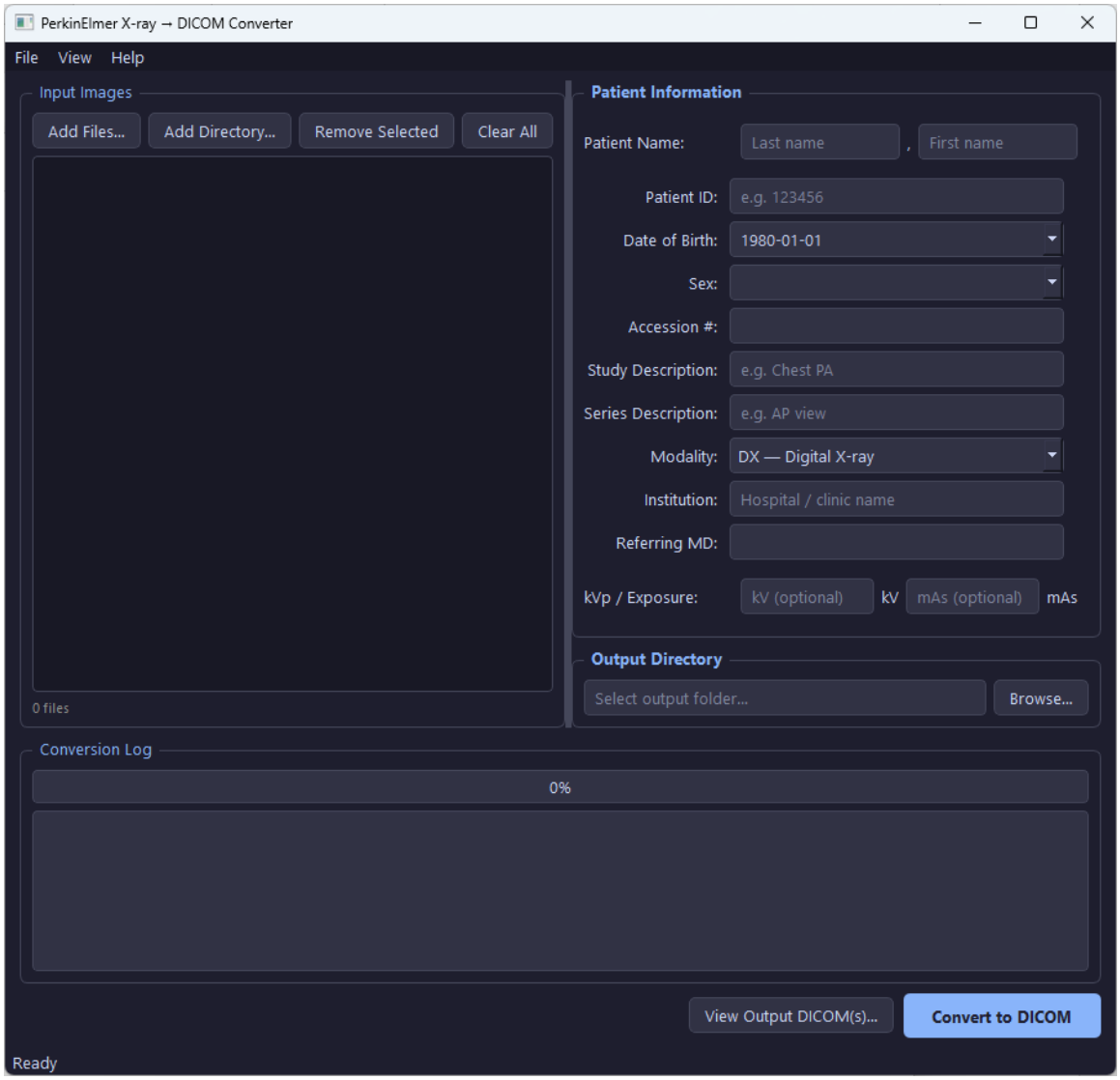
Component	Requirement
Operating System	Windows 10 or Windows 11 (64-bit)
Processor	Intel or AMD x86-64, 2 GHz or faster
Memory	4 GB RAM minimum; 8 GB recommended
Disk Space	200 MB for application; additional space for image files
Display	1280 × 800 minimum resolution
Network	Required only for DICOM export (C-STORE) feature

3. Installation

- Transfer the Xray2DCM.zip to the workstation of choice via USB flash drive or network transfer.
- Unzip and copy the Xray2DCM.exe file to a folder of your choice.
- Optionally, create a shortcut to Xray2DCM.exe and place on the Desktop.
- Double-click Xray2DCM.exe to launch the application.
- The dicom_hosts.csv file (saved SCP hosts) will be created automatically in the same folder as the executable on first use.

> ***i*** *Keep Xray2DCM.exe and dicom_hosts.csv in the same folder so that saved host entries persist between sessions.*

4. Application Overview



The main window is divided into three areas: the Input Images panel on the left, the Patient Information and Output Directory form on the right, and the Conversion Log panel at the bottom. A menu bar at the top provides access to additional features.

Element	Purpose
File menu	Clear the file list or quit the application
View menu	Open a standalone Image Viewer window
Help menu	Display the About dialog (version, author, disclaimer)
Input Images panel	Add/remove files or entire folders for conversion
Patient Information	Enter DICOM patient and study metadata

Output Directory	Select the folder where .dcm files will be written
Conversion Log	Progress bar and live status messages during conversion
Convert to DICOM	Start the batch conversion process
View Output DICOMs	Open converted files directly in the Image Viewer

5. Step-by-Step Usage

5.1 Adding Input Images

Use the buttons in the Input Images panel to load images for conversion.

- Add Files… — Opens a file browser. Select one or more image files using Ctrl+click or Shift+click for multi-selection. All supported formats are listed in the filter drop-down.
- Add Directory… — Scans an entire folder and adds all supported image files automatically, including extensionless PerkinElmer flat-panel files.
- Remove Selected — Removes the highlighted file(s) from the list.
- Clear All — Removes all files from the list.

> ***i*** *Double-clicking any file in the list opens it immediately in the Image Viewer for a quick preview before conversion.*

Supported Input File Formats

Extension	Description
.img	PerkinElmer legacy raw binary with .hdr sidecar header
(no extension)	PerkinElmer flat-panel detector format — detected automatically by the ### magic bytes in the embedded 320-byte header
.jpg / .jpeg	JPEG images (8-bit grayscale or colour; colour is converted to grayscale)
.png	PNG images (8-bit or 16-bit grayscale; colour converted to grayscale)
.tif / .tiff	TIFF images (8-bit or 16-bit; colour converted to grayscale)
.bmp	Windows Bitmap images
.dcm	DICOM files (viewable in the Image Viewer; not re-converted)

5.2 Entering Patient Information

Fill in the patient and study details in the right-hand panel. These values are embedded directly into the DICOM tags of every converted file in the batch.

Field	Description

Patient Name	Last name and first name entered in separate fields; combined as LastName^FirstName in the DICOM PatientName tag
Patient ID	Unique patient identifier (e.g., medical record number)
Date of Birth	Select from the calendar pop-up (stored as YYYYMMDD)
Sex	Male, Female, or Other
Accession Number	Optional accession or order number
Study Description	Brief description of the study (e.g., Chest PA)
Series Description	Description of the image series (e.g., AP view)
Modality	DX (Digital X-ray), CR, CT, MG, or OT
Institution	Name of the hospital or clinic
Referring MD	Name of the referring physician
kVp / Exposure	Optional beam energy (kV) and exposure (mAs)

> ***i*** *All patient fields are optional. If no patient name is entered, the application will prompt for confirmation before proceeding.*

5.3 Selecting an Output Directory

Click Browse… next to the Output Directory field and choose the folder where converted .dcm files should be saved. The folder will be created automatically if it does not already exist. Output files are named after their source file (e.g., A_40001_LI_xxx.dcm). A numeric suffix is appended automatically to avoid overwriting existing files.

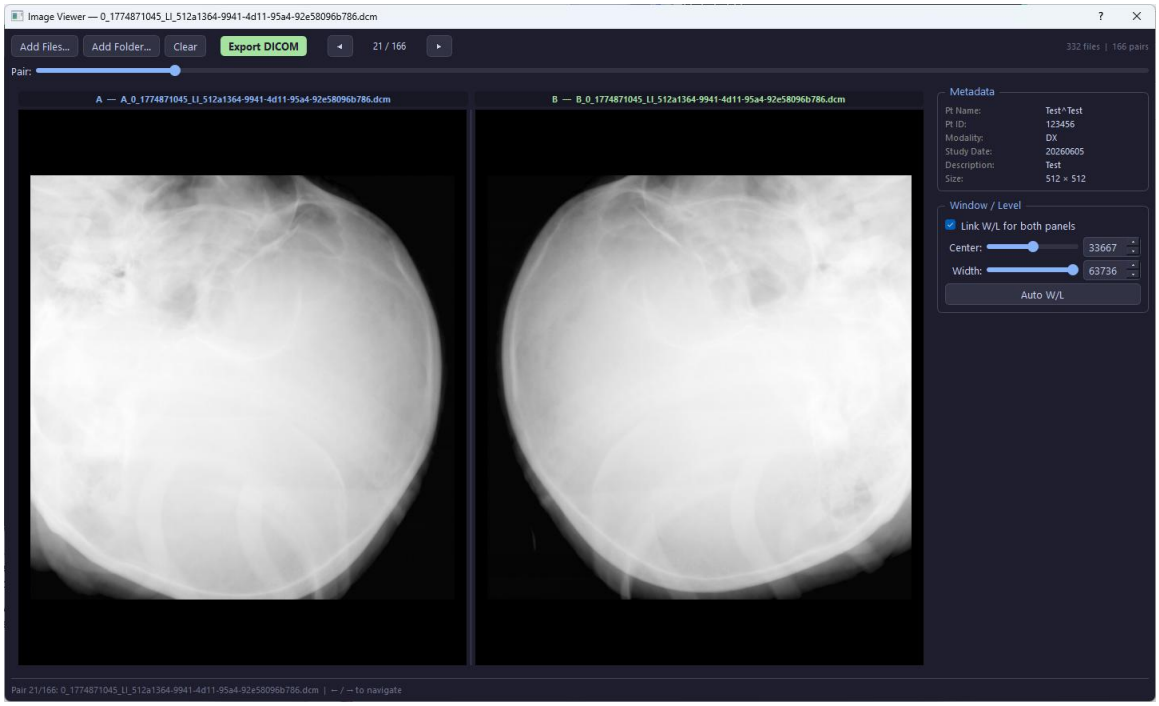
5.4 Running the Conversion

Click the Convert to DICOM button. The progress bar and log panel will update in real time as each file is processed. When conversion is complete, a summary dialog will confirm how many files were written and to which folder.

> **⚠ Do not close the application while conversion is in progress. The Convert to DICOM button is disabled during the operation to prevent duplicate runs.**

6. Image Viewer

The Image Viewer can be opened from the View menu, by double-clicking a file in the input list, or by clicking View Output DICOM(s)… after conversion. It supports both source images (PerkinElmer, JPEG, PNG, etc.) and converted DICOM files.



6.1 Loading Images

- Add Files… — Add one or more image files to the viewer's series list.
- Add Folder… — Scan a directory and add all supported images as a series.
- Clear — Remove all loaded images and blank the display.

> *i When a file is double-clicked in the main window's input list, the entire file list is passed to the viewer so you can navigate the full series starting from the clicked image.*

6.2 Navigating Between Images

Three methods are available for moving through a loaded series:

Control	Action
◀ / ▶ buttons	Step one image backward or forward
← / → arrow keys	Keyboard navigation (viewer window must have focus)
Mouse scroll wheel	Scroll up for previous, scroll down for next
Frame slider	Drag the slider below the toolbar to jump to any image
Frame counter	Shows current position as N / Total (e.g., 3 / 12)

6.3 Window / Level Adjustment

The Window / Level panel on the right side of the viewer controls image brightness (Level / Center) and contrast (Window / Width). Each parameter has both a slider and a numeric spin-box that remain synchronised.

- Center (Window Center) — Sets the midpoint of the displayed intensity range. Increasing the value brightens the image.
- Width (Window Width) — Sets the width of the displayed intensity range. A smaller width increases contrast; a larger width reduces it.
- Auto W/L — Automatically calculates optimal Center and Width values from the 1st and 99th percentile of the image data. For DICOM files, the embedded WindowCenter and WindowWidth tags are used if present.

> ***i*** *Slider ranges are automatically adjusted to match the actual pixel value range of each loaded image.*

6.4 Metadata Panel

The Metadata panel displays key information about the currently displayed image, including Patient Name, Patient ID, Modality, Study Date, Study Description, and image dimensions (width × height in pixels). For raw source images, only the size is populated; full metadata is available for DICOM files.

7. Exporting DICOM Files to a PACS / SCP

The Export DICOM feature sends all images currently loaded in the Image Viewer to a remote DICOM Service Class Provider (SCP) — such as a PACS system, Orthanc server, or any DICOM-compliant storage target — using the DICOM C-STORE protocol.

7.1 Configuring the SCP Connection

Click Export DICOM in the Image Viewer toolbar. The Export DICOM — SCP Connection dialog will open.

Field	Description
Calling AE Title	The AE (Application Entity) Title that this application will use to identify itself to the SCP. Defaults to XRAY2DCM.
Called AE Title	The AE Title of the destination SCP server. This must match exactly what the SCP is configured to accept.
IP Address	The hostname or IP address of the SCP server (e.g., 192.168.1.100 or pacs.hospital.org).
Port	The TCP port on which the SCP is listening. The standard DICOM port is 104; Orthanc defaults to 4242.

Once the Called AE Title, IP Address, and Port fields are filled in, the Export button becomes active. Click Export to begin the transfer.

> **⚠ Ensure the SCP is running and reachable on the network before clicking Export. The application will report a connection error if the association cannot be established.**

7.2 Saving and Reusing Host Entries

Frequently used SCP servers can be saved for quick retrieval.

- Fill in the Called AE Title, IP Address, and Port fields.
- Click Save Host. The entry is appended to dicom_hosts.csv in the application folder. Duplicate entries (same AE Title, IP, and port) are silently ignored.
- The next time the Export DICOM dialog is opened, all saved hosts appear in the Saved Hosts drop-down at the top of the dialog.
- Select a host from the drop-down to auto-fill all three fields instantly.
- To remove a saved host, select it in the drop-down and click Delete.

> *ℹ The dicom_hosts.csv file is a plain text CSV file and can be edited manually with any text editor or spreadsheet application if needed. Columns are: called_ae, host, port.*

7.3 Export Results

A progress dialog tracks each file as it is sent. When the transfer completes:

- If all files were sent successfully, an information dialog reports the count and destination.
- If any files failed, a warning dialog lists each failed filename alongside the specific error returned by the SCP.

Files that are not already in DICOM format (e.g., raw PerkinElmer images loaded directly into the viewer) are converted to DICOM in memory before transmission — no intermediate .dcm file is written to disk for those entries.

8. dicom_hosts.csv File

All saved DICOM SCP hosts are stored in a plain-text CSV file named dicom_hosts.csv, located in the same directory as the application executable or main.py script.

8.1 File Format

The file uses the following column structure:

Column	Description
called_ae	AE Title of the SCP server (e.g., ORTHANC)
host	IP address or hostname (e.g., 192.168.1.100)
port	TCP port number (e.g., 104)

Example file contents:

```
called_ae,host,port
ORTHANC,192.168.1.100,4242
PACS_PRIMARY,10.0.0.5,104
```

⚠ **Do not move dicom_hosts.csv to a different folder. The application always reads from and writes to the folder containing the executable — not the working directory.**

9. Troubleshooting

Issue	Resolution
Unsupported file format error	The file has no extension and does not begin with the ### PerkinElmer magic bytes, or the extension is not in the supported list. Verify the file is a valid image. Use Add Files… and select All Files (*.*) to browse extensionless files.
Cannot determine image dimensions	The PerkinElmer .hdr sidecar file is missing or does not contain Rows/Cols fields. Ensure the .hdr file is in the same folder as the .img file.
W/L slider has no effect	Ensure an image is loaded in the viewer. The sliders are only active when a valid image is displayed. Try clicking Auto W/L to reset to defaults.
Export fails — could not associate	Check that: (1) the SCP server is running, (2) the Called AE Title matches the SCP configuration exactly (case-sensitive), (3) the IP address and port are correct, and (4) no firewall is blocking the connection.
Saved hosts not appearing	Confirm that dicom_hosts.csv exists in the same folder as the .exe file. If running as an .exe, do not place it in a read-only directory such as C:\Program Files\.
Black image in viewer	The Window Width may be set to a very small value. Click Auto W/L to recalculate appropriate Window/Level values for the image.
Conversion completes but DICOM files are empty	Verify the Output Directory path is valid and the application has write permission to that folder.

10. Keyboard Shortcuts (Image Viewer)

Key / Action	Function
← Left Arrow	Navigate to the previous image in the series
→ Right Arrow	Navigate to the next image in the series
Scroll Wheel Up	Navigate to the previous image
Scroll Wheel Down	Navigate to the next image

11. Technical Reference

11.1 DICOM Tags Written During Conversion

Tag	Attribute	Source
(0010,0010)	PatientName	Entered last^first name
(0010,0020)	PatientID	Patient ID field
(0010,0030)	PatientBirthDate	Date of birth (YYYYMMDD)
(0010,0040)	PatientSex	M, F, or O
(0020,000D)	StudyInstanceUID	Auto-generated; shared across all files in one batch
(0020,000E)	SeriesInstanceUID	Auto-generated per conversion run
(0008,0060)	Modality	DX, CR, CT, MG, or OT
(0008,1030)	StudyDescription	Study description field
(0008,103E)	SeriesDescription	Series description field
(0008,0080)	InstitutionName	Institution field
(0008,0090)	ReferringPhysicianName	Referring MD field
(0018,0060)	KVP	Beam kV (if entered)
(0018,1152)	Exposure	mAs (if entered)
(0028,0030)	PixelSpacing	Extracted from PerkinElmer header (0.2780 mm typical)
(0028,1050)	WindowCenter	Auto-calculated from pixel data
(0028,1051)	WindowWidth	Auto-calculated from pixel data

11.2 PerkinElmer Flat-Panel File Format

CyberKnife live x-ray images are stored as raw binary files with no file extension. Each file begins with a 320-byte ASCII header followed immediately by raw pixel data.

Property	Value
Magic bytes	First 3 bytes are ### (0x23 0x23 0x23)
Header size	320 bytes, ASCII text with null padding
Header format	### <cols> <rows> 0 0 1 0 ...
Pixel data	Immediately follows the 320-byte header; uint16 little-endian for full-resolution images (1536×1536); uint8 for correction frames (512×512)
Pixel spacing	Encoded near offset 240 as ~<row_sp><col_sp> in cm (e.g., ~0.02780.0278)

Typical size	4,718,912 bytes for a 1536×1536 uint16 image

12. Disclaimer

This application is an independent third-party tool and is not affiliated with or endorsed by Accuray, Inc.

This application is not certified for use in a clinical environment for diagnosing medical conditions. Its purpose is restricted to converting x-rays to DICOM, viewing and exporting of DICOM to 3rd party modalities and may not be used for diagnostic interpretations. It is the responsibility of the end user to verify the accuracy and integrity of converted DICOM files before use.

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