



Keiron 1.0

DICOM Viewer App

User Guide

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Made in Italy.

Rev 2.0

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Introduction

Keiron is a DICOM Viewer Application designed to give access to bio-medical images, as well as diagnostic tools, from mobile devices. It's a stand alone software solution to visualize, inspect and make annotations on medical images from iPad. The App is thought to be a user-friendly mobile environment to manage and integrate imaging data coming from different scanning hardwares and diagnostic devices.

Keiron App software is divided in five major Section:



Patient Section: in this Section the user can browse and organize the metadata of the medical images stored on the device's memory. Thanks to a clear user interface and to effective search and filter tools, browsing the database is fast and easy.



Viewer Section: the heart of Keiron software, here is where medical images (CT, MR, etc.) are displayed, both in single or double view.



Download Section: once the device is synchronized to the hospital network, it is possible to query one of the registered PACS. Several filtering options allow to retrieve and download the desired Study in a fast way.



Settings Section: synchronize the device to the hospital PACS, or add a DICOM node to the device network, is straightforward even for a non technical user.



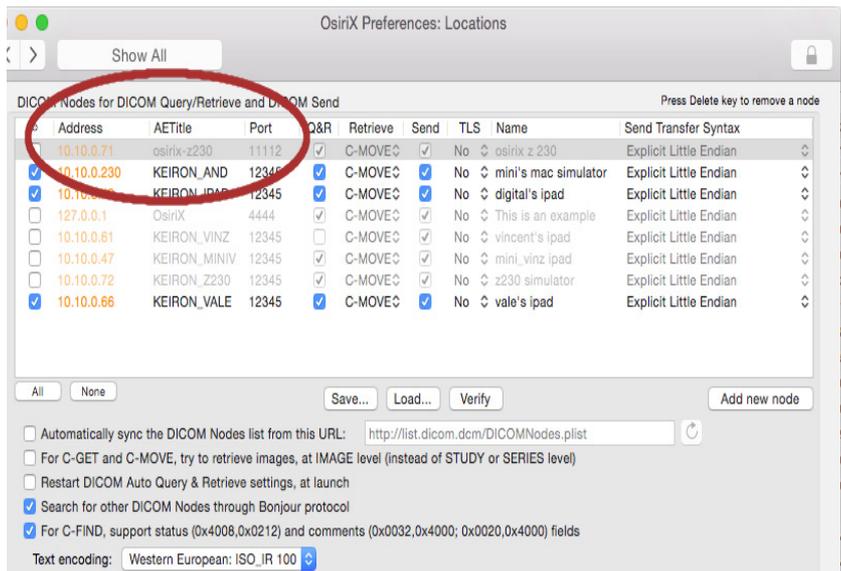
Diagnostics Section: this Section is a showcase for the diagnostic tools available to purchase. Here the user can find a description of the tools, try their functionality on example images, buy them by in-app purchase mechanism.

Getting Started

In this Section a step by step guide to connect and synchronize your device with a PACS System, in order to import your first DICOM Study in Keiron.



Keiron can be synchronized with any PACS SYSTEM. To show an actual example, we now consider the case where the PACS is an OsiriX Mac workstation.



To start using Keiron:

- Open OsiriX software on your workstation.
- Open Keiron App on your mobile device.
- Go to the *Network Settings* Section of Keiron. (see Previous Image)
- In *Dicom Nodes* Section you find the list of AETitles of the public nodes on the network.
- Click on the plus icon of the node you want to add.
- Text a name for the node in *Description* field.
- Press **Done**.

The nodes you can add have green plus icon on the left. Between them you should find the AETitle of your OsiriX workstation. If you don't see the plus icon, press **Edit**.

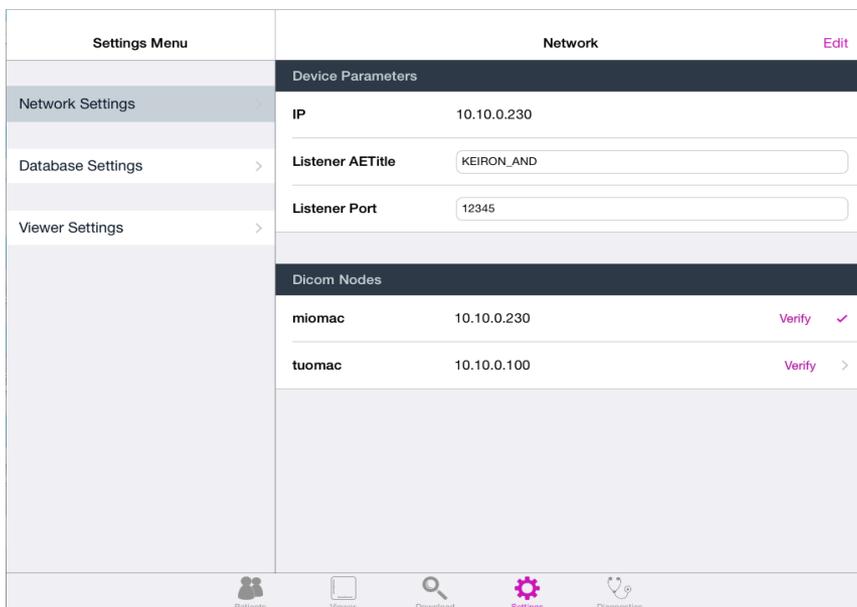
Note: In case you cannot find the AETitle of your workstation there is probably a problem with your network connection: check your mobile device and workstation Wi-Fi are on.

The newly added node should now be visible in *Dicom Nodes* Section. You can **Verify** it to see if it is active and responding.

You can also manually add a node if you know its IP address, port and AETitle. In OsirX for Mac this information is grouped in a panel you can open by selecting *Menu Preferences -> Listener*.

To manually add a node in Keiron, in *Network Settings* **Edit** mode, click the plus icon on the side of the *Add New DICOM Node* tag, and insert all the required fields.

Now you have to register your device as an authorized DICOM node in OsiriX configuration.



To register your device:

- Go to Menu *Preferences* -> *Locations of OsiriX*.
- Click on "add new node".
- Specify the parameters of your mobile device in IP, AETitle Listener, Port Listener fields. You can find this information in *Device Parameter* Section of Network Settings in Keiron.

Now that Keiron is connected and synchronized with your PACS System, you can download data from it.

Note: AETitle is a unique, case sensitive, string identifier of a DICOM node. This means you cannot connect two Keiron devices to your workstation using the same AETitle. To do that, you have to edit the AETitle of one of your devices. Be sure to synchronize this change with OsiriX Location configurations.

To download data:

- Go to *Download Section* of Keiron.
- Set the newly added node in *Query Settings*.
- Press **Query**.

The list of Studies present on PACS database should appear in the Results Panel. You can refine the search by adding some fields in Query Settings.

To download a Study:

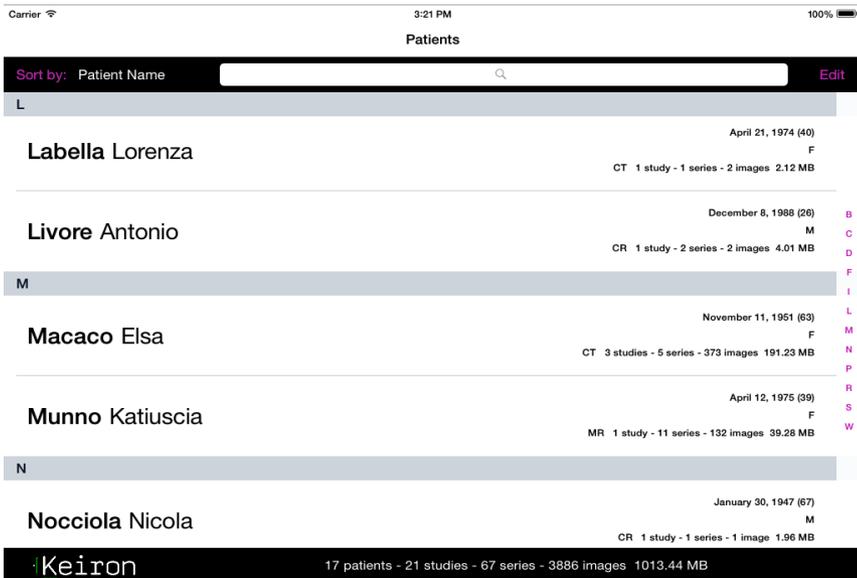
- Select the Study.
- Press **Download**.

A red popup should appear on *Download Section* icon to inform you that a downloading operation is in progress. At the end of the download the Study will be added to the *Patient Section* of Keiron.

Note: The entire operation is not difficult in itself, but could result complex for users not confident with IT. If necessary ask for the help of a technician.

Patients Section

In this Section you can manage and organize the local database.



Carrier 3:21 PM 100%

Patients

Sort by: Patient Name Edit

L

Labella Lorenza April 21, 1974 (40) F
CT 1 study - 1 series - 2 images 2.12 MB

Livore Antonio December 8, 1988 (26) M
CR 1 study - 2 series - 2 images 4.01 MB

M

Macaco Elsa November 11, 1951 (63) F
CT 3 studies - 5 series - 373 images 191.23 MB

Munno Katiuscia April 12, 1975 (39) F
MR 1 study - 11 series - 132 images 39.28 MB

N

Nocciola Nicola January 30, 1947 (67) M
CR 1 study - 1 series - 1 image 1.96 MB

Keiron 17 patients - 21 studies - 67 series - 3886 images 1013.44 MB

The main view contain a table with all the Patients whose Studies were imported in Keiron. Selecting one of them will open the Studies Panel on the right (see above image).

Main Panel:

Main Table:

This table shows the local database content grouped by Patients. Each entry provide information about patient name, surname, birthday, current age, and gender. Further details about related Studies, such as modalities and composition, are provide as well. You can delete a Patient entry from your local database by pressing **Edit** and then the minus icon.



Sort Tool:

By default the main table is sorted by Patient name. To change this, press **Sort** by "Last study Date" or Study "Download Date".

Search Tool:

You can filter the local database by typing text in the top search bar. The filter will be applied to substrings of Patients name and surname, as well as to the modalities of their Studies. For example typing "mr" will show you all the Patients with a Magnetic Resonance (MR) Study.

Note: Remember to clear the bar text after you perform a search, since a previously selected filter could hide part of your database.

Studies Panel:

- Main Table:** This table shows the Series of the selected Patient grouped by Study. Each entry provide a thumbnail of the first Image of the Series, as well as information about Series description, modality and number of Images. You can delete a Series entry or an entire Study section from your local database by pressing **Edit** and then the related minus icon.
- Sort Tool:** By default the Series table inherits the sorting option of the Main Panel. You can change it pressing **Sort by**.
- Search Tool:** You can filter the Study content by typing text in the top search bar. The filter will be applied to substrings of Study description as well as Series description and modalities.
- Add series Tool:** It is possible to add a Secondary Capture (SC) Series to the selected Patient. To do that click on the plus icon in the Study section you want the new Series to be added.
- **Picture from Camera:** take a picture from the your device camera and it will saved as new DICOM Series in Keiron.
 - **Picture from Gallery:** browse the photos gallery of your device and choose one image, it will saved as new DICOM Series in Keiron.
 - **Temporal-Spatial Series:** it is possible to create a new temporal Series by extracting images from a number of spatial organized Series present in local database, and vice-versa. Choosing this option will open the *Create New Series* panel.

Create New Series:

Description: This panel contains a Studies table and a Viewer. A possible study case to show its functionality is the following: imagine you have a number of MR Series in a contrast-enhancement Study . Each Series was catch at a different time after contrast administration and is spatially organized, i.e. its Images are slices at different position of the same anatomical region. You would like to have a new Series showing the time evolution at a specific slice position, that means you have to convert the spatial source Series organization into a temporal one.

- Create TS Series:**
- Select the source Series you want to convert.
 - Position the slider of the Viewer in the desired Series slice.
 - Insert the name for the new Series in the top bar.
 - Press **Create Series**.
 - The newly create Series will be added to the selected Study.

Note: The right and meaningful selection of source Series is upon you. Keiron just requires to have them made up by the same number of Images.

Viewer Section

This is the main Section of Keiron. Here you can browse through the Images of a Series, visualize and annotate them by the mean of useful tools such as ROI.



Extra tools, such as an internal link with Diagnostics Section, will let you access specific diagnostics tools or share the current contents on the web.

Main Elements:

- Info:** Superimposed to the Image you can find useful information:
Images Info: On the top left. Information about the luminosity and contrast (WL-WW) settings of the Image, as well as slice location and thickness.
General Info: On the top right Information about the medical institution where the Study was performed and a recap of Patient, Study and Series details.
Location Info: On the four borders of the Viewer a capital letter will help you to understand the orientation of the Image with respect to patient position: Left, Right, Anterior, Posterior, Feet, Head.
- Slider:** On the bottom of the Viewer a slider will let you navigate through the Images of the Series.
- Ruler:** On the left and on the bottom there are two green rulers to help you understand the real measures of the Image. Rulers are shown only if the DICOM file contains information about spatial measurements.
- Reslice:** On the bottom-right you find the Reslice button. This functionality is active only if the Series supports it, i.e. if it is uniformly spatial-organized. By pressing this button a new Series is generated from an orthogonal orientation with respect of the source one. You can cycle over the three possible orientations by further pressing the button.

Basic Tools:

- Browse:** To flip through the Images of the Series by left-right panning with a finger over the device screen.
- Luminosity:** To manually change the Window Level (WL) and Window Width (WW) of the Image. Up-down panning will result in a change of luminosity, whereas left-right panning in a change of contrast.
- ROI:** Region Of Interest (ROI) tool allows you to highlight and extract statistics from a part of the Image. In order to select and edit a ROI and its info balloon, this tool should be active.
You can choose between different ROI shapes:
- Point
 - Segment
 - Rectangle
 - Ellipse
 - Curve

And two different actions over *ROIs*:

Propagate ROI: this will copy the selected ROI over all the Images of the Series.

Delete ROIs: you can decide to delete all the ROIs currently shown in the Viewer, or delete all the ROIs added to the Images of the whole Series.

If a ROI is selected, its info balloon will show a "Add Text" tag on the right bottom. Tapping over it will open a field where you can add custom text annotations. This text will be saved with the ROI.

Other Tools:

Series: Click on this button and a Series Selector will appear. All the Series of the Patient, grouped by Study, are shown in it. You can show and hide a Study preview by pressing the related numbered cell.

You can change the Series shown in the Viewer by clicking on its thumbnail and pressing over the small arrow pointing towards the Viewer.

Another click over the "Series" button will hide the selector.

Split: Keiron supports a double Viewers modality to show two different Series at the same time. Once in split mode, use Series Selector to visualize and make comparison over two different Series.

On the bottom the Series Selector a lock button will synchronize the browsing, by slider or pan, over the two Series.

If the orientations of two Series of the same Study are orthogonal, purple lines will appear over them to signal the cut lines of the slices planes.

Note: Slip view used in coordination with Reslice tool will allow you to make a clear 3-dimensional representation of the anatomical region under inspection.

100%: Click this button to reset Image center and zoom.

Hide: This button hide in a step-by-step cycle all extra elements (ROI, Info, Rulers) added to the Viewer.

V.O.I.: Here you can select and apply one of the Values Of Interest (VOI) presets for the WW and WL. You can edit and add new presets in the *Viewer Settings*.

Extra Tools

Share:

You can share the content of the Viewer as images in png or jpeg format, using:

- Email: a standard email with the selected Images in attachment will be created. You just have to specify the address, eventually customize object and message text, and press **Send**.
- DropBox: Keiron will synchronize with the Dropbox App on your device. Choose name and extension of the Images you want to upload to your dropbox folder, and press **Publish**.

Note: Be sure your device network connection is active before access share functionality.

Diagnostic:

It is possible to access Keiron Diagnostic Section directly from the Viewer. Beyond standard Tool and In-app purchase info, you can also execute specific Tools. For already purchased Tools, you can launch them on the current Series, by pressing Execute. In case of not-purchased Tools, Keiron gives you the possibility to Try them on default Images.

Note: In Viewer presentation other than the main one, for example inside a Diagnostic Tool, specific tools may appear in this Section.

Download Section

In this Section you can query a network's DICOM node to visualize the Studies present in its database. The main view of this Section is divided in two panels, Query Settings on the left and Results Panel on the right.

Query Settings	Results	Current Download
Clear	Query	Clear Selection
		Download
	11/20/06, 6:28 AM	Remote: 11 series - 679 images
Dicom Node set a node miomac	Battistoni Alberto	M February 21, 1949
	Tumor Vol + Si	MR Local: 10 series - 889 images Remote: 15 series - 904 images
Patient Name <input type="text"/>	2/21/04, 2:46 PM	
	Tumor Vol + Si	MR Local: 10 series - 888 images Remote: 12 series - 888 images
Modality set study modality	4/28/04, 5:44 PM	
	Battistoni Francesco	M July 12, 1954
Date set a date	Brain Volume 3	MR 8/17/07, 8:32 AM Remote: 11 series - 371 images
	Brain Volume 5	MR 9/6/06, 12:26 PM Remote: 11 series - 383 images
Patient ID <input type="text"/>	Brain Volume 2	MR 12/2/07, 11:44 AM Remote: 12 series - 1589 images
Referring Physician <input type="text"/>	Brain Volume 6	MR 3/24/06, 9:30 AM Remote: 11 series - 786 images
1972 images to Download	Brain Volume 1	MR
		
		

Note: The basic networking element for the present version of the software is the Study. This mean it is not possible to query and download single Series or Images.

To download data:

- Specify the filtering options in *Query Settings*.
- Press **Query**.
- Browse the returned Studies in *Results Panel*.
- Select the Studies you are interested in.
- Press **Download**.
- Visualize advancement status in *Current Downloads*.
- Retrieve completed download in *Patient Section*.

Note: To fix PACS problems:

- Check your device WI-Fi is on.
- Be sure you synchronizes correctly your device to the PACS, as explained in *Getting Started*.
- Check the spelling of the AETitles, on PACS and in *Keiron Network Setting*.
- Keiron needs to be restarted if you have changed your AETitle in *Network Setting*.
- **Verify** the PACS node activity in *Keiron Network Setting*.

Query Settings

- Dicom Node:** Set the Dicom node you want to query. You can choose between the nodes you have previously added in the Settings Section.
- Patient Name:** Specify a string or substring of the name or surname of the Patient you are looking for.
- Modality:** You can filter query results choosing the modality of the Study (MR, CT, DX, etc.). Multiple modalities filter is also available.
- Date:** Specify the date or the time range when the Study you are interested in was performed. Several presets are available, you can also edit the extremes of a preset.
- Patient ID:** Primary hospital identification number or code for the Patient, an unique identifier string that DICOM associate to each patient in PACS database.
- Referring Physician:** The name of the physician associated to the Study. Pay attention, this is not a requested DICOM field, no results are guaranteed.

Note: Always remember to **Clear** the settings after you perform a query. Previously set fields could not match with the present query you are performing, leading to a “No results” response from the PACS.

Results Panel

Here you can find the Studies obtained from the PACS after you have pressed the **Query** button on an active DICOM node and with valid query settings. Studies are banded together and sorted by Patient name. Details about Study description, date, time and modality, as well as the main information about the Patient are displayed for convenience. Further information about the number of Series and Images in the Study, both on the remote (PACS) and the local (user device) is given.

Current Downloads

After you have pressed **Download**, Keiron asks the PACS the list of Studies you have selected. A red popup with the number of the retrieving Studies and their state of advancement will then appear over the *Download Section* icon. In this panel you can find details about the list of Studies in download. It is possible to cancel the download of a single Study by pressing **STOP**, or cancel the last download order by pressing **Stop all**.

Settings Section

In this Section you can set up Keiron configurations. The most important of them are *Network Settings*, that will allow you to connect your device to the current PACS network. The main view of this Section is divided in two panels. The panel on the left is a Settings Menu.

Settings Menu	Network Edit
	Device Parameters
Network Settings	IP 10.10.0.230
Database Settings >	Listener AETitle <input type="text" value="KEIRON_AND"/>
Viewer Settings >	Listener Port <input type="text" value="12345"/>
	Dicom Nodes
	miomac 10.10.0.230 Verify ✓
	tuomac 10.10.0.100 Verify >

 Patients  Viewer  Download  Settings  Diagnostics

Choosing between *Network*, *Database* and *Viewer Settings* you will see the proper details panel on the right.

Network Settings

- Device Parameters** These are the basic network parameters of your device: you will need them to properly synchronize your device to the network of the PACS, as explained in the *Getting Started*.
- IP:** The network address of your device.
- Listener AETitle:** The unique identifier of your device as DICOM node. This field is set by default to KEIRON_IPAD, however you will probably have to change it if several device using Keiron will be present on the same network. Pay attention this field is case sensitive (capital letters should be right). Once you have changed the AETitle of your device you will have to close and restart Keiron App before performing networking again.
- Listener Port:** The port of your device reserved to this network service.
- DICOM Nodes** A list of all the DICOM nodes registered on your device. You can **Verify** a node sending it a ping to see if it is currently active.
To link new nodes to your devices, or unregister some of them, press **Edit**, you should then be able to add or delete a node clicking on the proper icon.

New DICOM Node

- Description:** The name you want to associate to the new node. This is the name you will find in **Query Settings**, so choose clearly identifiable names to easily switch between them.
- Address:** The IP address of the DICOM node you want to add.
- Port:** The port of the node reserved to this network service.
- AETitle:** The unique identifier of the node. Pay attention that this field is case sensitive.
- Retrieve Modality:** A parameter of the DICOM communication standard. It is set to **MOVE** by default, you can possibly switch to **GET** modality.

Note: To resolve problems of connection with the PACS:

- Check your device WI-Fi is on.
- Be sure you synchronizes correctly your device to the PACS, as explained in *Getting Started*.
- Check the right spelling of the AETitle, both on PACS and device side.
- If you have changed your AETitle, Keiron needs to be restarted.
- Verify** the problem doesn't depend on PACS side.

Database Settings

In Database Management you can **Clear Local Database**. This action will remove all the Studies present in Keiron database, clearing the memory of your device.

Note: This command cannot be undo: you will lose the data in Keiron database in a permanent way. If the database is large, this operation could possibly require a long time.

Viewer Settings

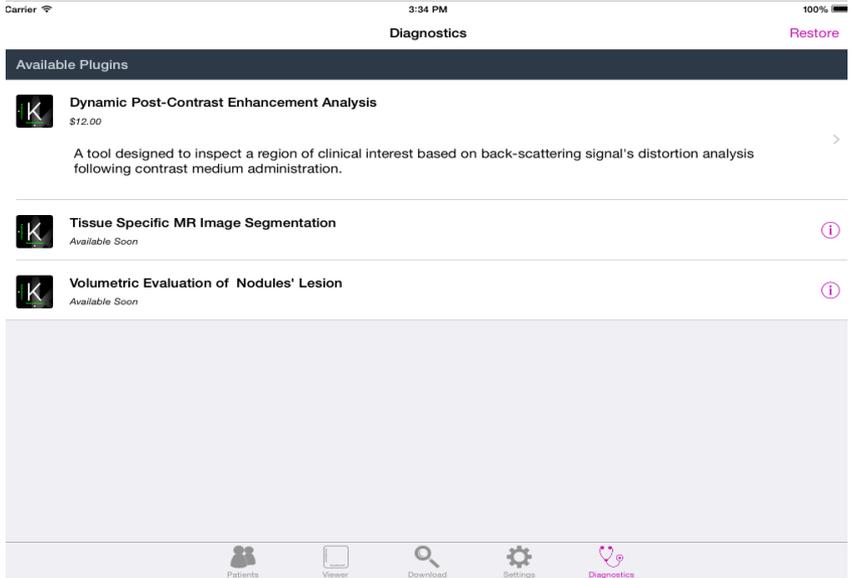
V.O.I. management:

- Click on one of them.
- Insert new values for the fields Description, Window Level (WL) and Window Width (WW).
- Press **Done**.
- It is possible to add a new V.O.I. preset:
- Choose **Edit** .
- Press the Add icon at the end of the table.
- Insert values for the fields Description, Window Level (WL) and Window Width (WW).
- Press **Done**.

Note: It is also possible to restore the initial presets by pressing **Reset**. All changes done on V.O.I. presets will then be lost.

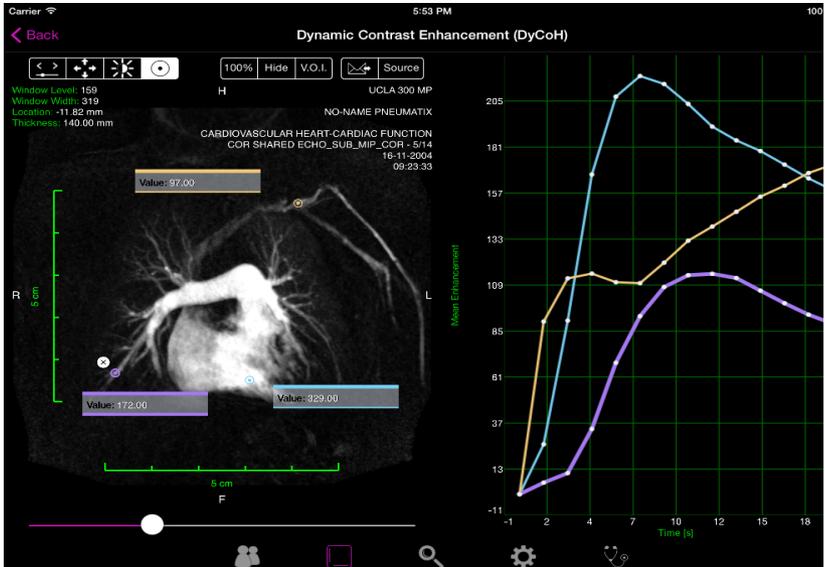
Diagnostics Section

In this Section you find the list of tools available for in-app purchase (see figure below).



You can access technical information about each diagnostic tool and **Buy** the one you more need.

DyCoH



Description:

A tool designed to inspect a region of clinical interest based on back-scattering signal's distortion analysis following contrast medium administration. DyCoH is a non-invasive method allowing to determine the type of vascularization analyzing the perfusion's dynamic of contrast media in the tissues. This tool allows to examine the specific contrast's perfusion phenomenon both on its spatial scale (a whole target organ) and on the temporal one (perfusion dynamics). The main output of DyCoH are four colour-maps that radiologists can use to identify the most relevant areas over which dynamically evaluates the contrast enhancement curve.

Clinical Advantages:

Contrast agents' use is a consolidated instrument in medical image diagnostics, for it allows to selectively enhance/mask target tissues from the background context. DyCoH, being specifically designed for this kind of analysis, provides all the information needed to perform the contrast enhancement analysis in a user-friendly framework.

This panel is made of a Viewer and a Chart.

Note: To a proper use, DyCoH Tool should be executed on a temporal-organized Series of a contrast-enhancement Study. Refer to *Create New Series* for temporal-spatial Series conversion.

Use of DyCoH :

- Select ROI tool in the Viewer and choose the desired shape.
- Draw a ROI where you want to analyze the enhancement curve.
- Inspect the enhancement curve in the Chart view.

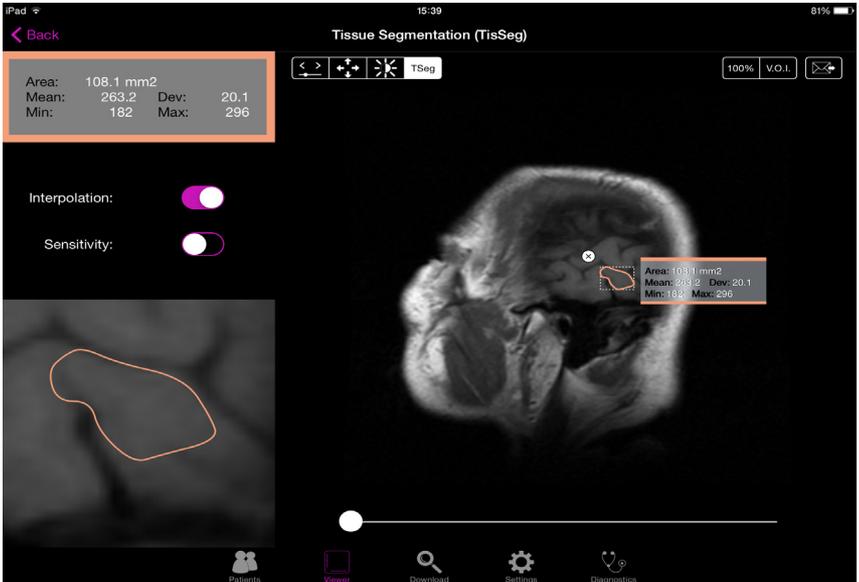
DyCoH creates colour-maps useful for the enhancement analysis, to cycle over them you have to press the top right button ("Source") in the Viewer.

Area Under the Curve ("AUC") represents the area under the enhancement curve:

Local Peak Intensity (LPI) is the maximum increment of intensity w.r.t. the corresponding basal value:

Time To Peak (TTP) is the time instant when the intensity reaches its maximum value.

Average rising (SLOPE) is a measurement of the slope of the curve.



Description:

A tool for cutting and highlighting given portions of tissue in a semi-automatic way inside a series. The user can easily and intuitively identify and highlight the desired portion of tissue using very simple gestures.

Different views of the image segmentation are provided, in order to give maximum precision and visual feedback to the segmentation process. The segmentation of the area in the whole series is real-time and interactive, with the possibility of later adjustments if necessary. As a result a new segmentation ROI is created and added to each series' image.

Clinical Advantages:

This Tool allows you to create ROIs in a more precise and fast way. It automatically detects the different types of tissue, isolating the relevant area.

Use of TisSeg:

- Select an image.
- Press the **Diagnostic** button, on the upper right.
- Choose **TisSeg** in the Available Tools list.
- Press **Execute** at the right of the Tool name.
- Click in any point of the image and drag up and down, to automatically create a ROI. The more you drag up the more the area will spread. The area where you are working is shown, magnified, on the left in order to control more sharply the shape of the area.

There are two options available during the ROI creation:

Interpolation: if activated, makes the ROI smoother, representing it as a curve. If deactivated, the ROI will appear pixelated.

Sensitivity: if activated, increases the speed with which the ROI's area spreads, while you are sliding on it.