

EATSeg Manual

Version 0.1

Introduction

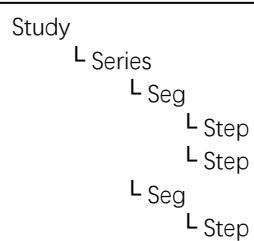
EATSeg is a tool designed to help clinicians and researchers efficiently carry out epicardia adipose tissue (EAT) related researches. A automatic pericardium segmentation module based on a deep neural network is developed, which is convenient for users to quickly extract the corresponding area of EAT.

Note: Deep neural network is a representation learning algorithm that can extract abstract features at different levels of data.

Due to the limitations of the modeling data set and the model itself, the automatic segmentation results may not be satisfactory. For this reason, EATSeg also provides a variety of commonly used manual and semi-automatic image annotation tools, which also means that EATSeg is not limited to EAT related researches.

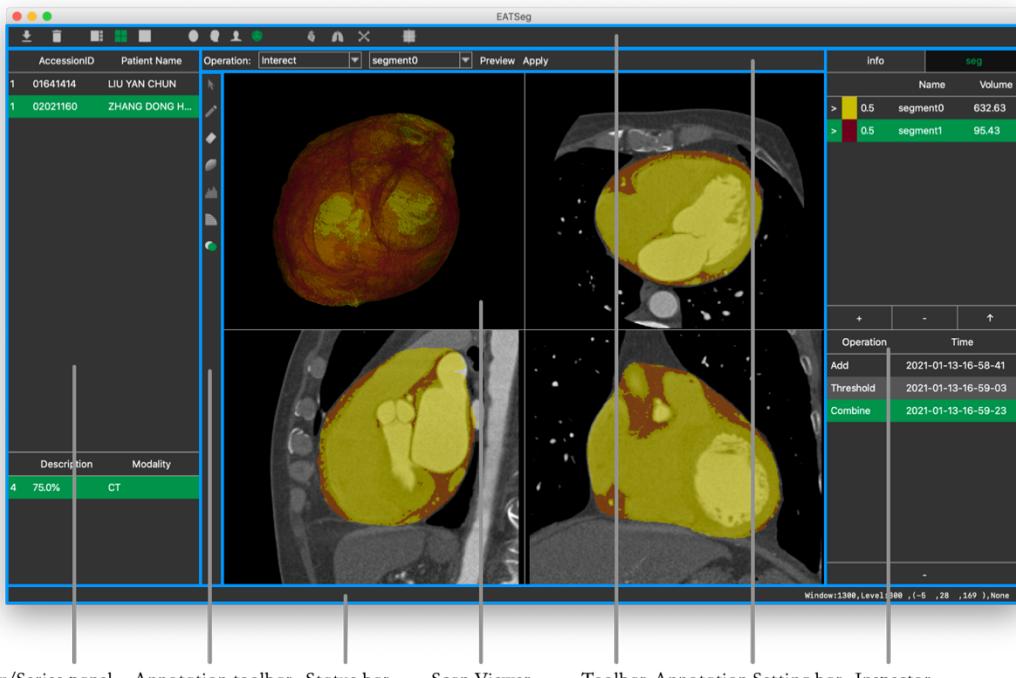
Note: EAT is adipose tissue located in the pericardium, mainly distributed around the atrioventricular groove, interventricular groove and coronary artery tree. In recent years, studies

have found that the thickness, volume, and density of EAT are related to various cardiovascular diseases.



Four types of objects are involved in EATSeg, as shown in the figure above, which are Study, Series, Seg, Step. The concepts of Study and Series come from Dicom images. Seg and Step are similar to layers and historical records in image editing software. Multiple regions of interest (Region Of Interest, ROI) can be drawn for Series, and each ROI is a Seg. The editing process of each Seg consists of multiple Steps, which is convenient for the user to roll back the corresponding operation.

Interface



Study/Series panel Annotation toolbar Status bar Scan Viewer Toolbar Annotation Setting bar Inspector

The main interface of EATSeg consists of 7 parts, namely the Study/Series panel, annotation toolbar, status bar, scan viewer, toolbar, annotation setting bar, and inspector.

Study/Series Panel

Display and manage the imported image data. Click the entry in the Study table to display the Series entries it contains. Click the corresponding entry in the Series table to display the images in the image viewer.

Annotation Toolbar

Arrow

In the 2D view, press the left mouse button to adjust

the window/level. Hold down the Command (Control under Windows) key while pressing the left mouse button to change the image slice. Press the right mouse button to zoom the image. Hold down the Shift key while pressing the left mouse button to drag the image.

In the 3D view, press the left mouse button to change the viewing location. Press the right mouse button to zoom the viewing angle.

Paint

After selecting the Seg, press the left mouse button and move to delineate the ROI.

Erase

After selecting the Seg, press the left mouse button and move to erase the delineated area.

Pericardial Segmentation

After selecting the Seg, use this tool to automatically segment the pericardium.

Threshold

After selecting the Seg, set the thresholds and use this tool to extract all pixels in the image within the set thresholds.

Smooth

After selecting the Seg, select the appropriate smoothing algorithm and corresponding parameters, and apply the tool to smooth the delineated area.

Combine

Combine the selected Seg with other Segs.

Status Bar

Used to display some prompt messages.

Scan Viewer

View and interact with images.

Toolbar

Import Dicom

Import Dicom images from a folder.

Delete Study

Delete the selected Study and its corresponding

Series, Seg, Step and other records.

View Mode

Switch between three view modes.

Main View

Focus on the axial, sagittal, coronal, and 3D views separately.

Window/Level

Switch to mediastinal, lung, bone window/level.

Reset View

Reset view position and angle.

Annotation Setting Bar

Set the parameters corresponding to each annotation tool.

Inspector

Basic Info Inspector

info	seg
Name: ZHANG DONG HUA	
Sex: F	
Sge: 67	
CaseID: 7954923	
StudyID: 3051	
Study Date: 20190101	
Study Time: 090422	
AccessionID: 02021160	
Series Number: 4	
Series Date:	
Series Time:	
Description: 75.0%	
Modality: CT	

Display basic information of Study and Series.

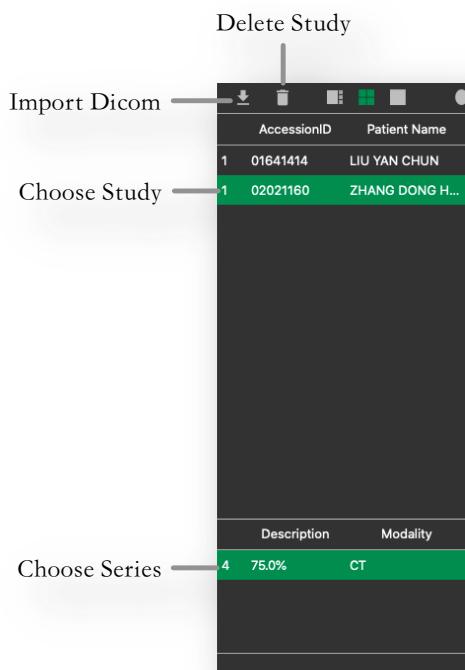
Seg/Step Inspector

info	seg
Name Volume	
> 0.5	segment0 632.63
> 0.5	segment1 95.43
+ - ↑	
Operation Time	
Add	2021-01-13-16-58-41
Threshold	2021-01-13-16-59-03
Combine	2021-01-13-16-59-23
-	

Show Seg and its corresponding Step list. Click the item in the Seg list at the top of the inspector to select the corresponding Seg. Seg name, transparency and visibility can be changed. Segs can be added, deleted, and exported. Click the corresponding entry in the Step list in the lower half of the inspector to roll back to the editing process.

Example

Manage Image Data



Click the Import Dicom button in the toolbar, and select the folder to be imported in the file dialog box that pops up.

Click an item in the Study list to select Study.

Click an item in the Series list to select Series.

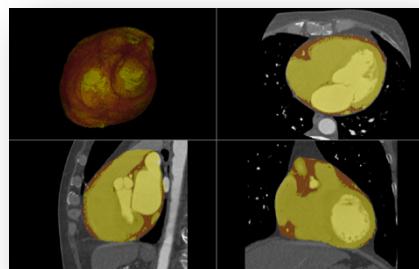
Click the Delete Study button in the toolbar to delete the selected Study and its corresponding files from the database.

Note: After selecting Study, the Series list will automatically update to all the Series entries of the Study. After selecting the Series, the image viewer will automatically update to the image of the Series and its Seg, and the inspector will also update to the corresponding content of the Series.

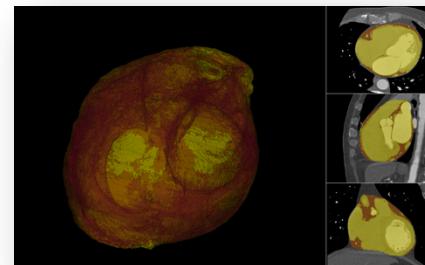
View Image

Switch View Mode

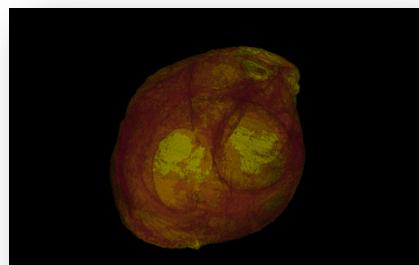
Click and switch to the following view:



Click and switch to the following view:

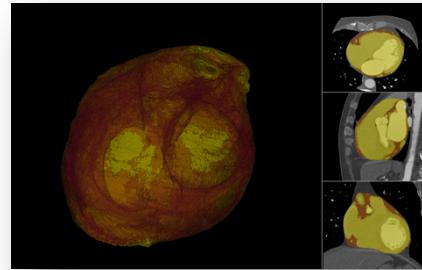
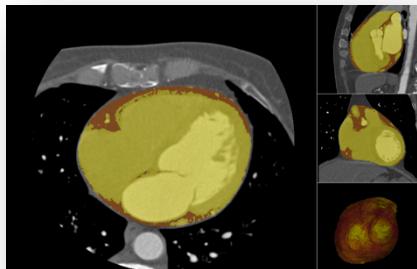


Click and switch to the following view:

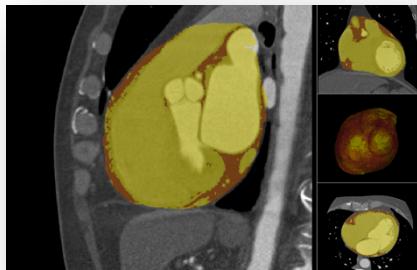


Change the Main View

Click  and set the main view as the axis image:



Click  and set the main view as the sagittal image:



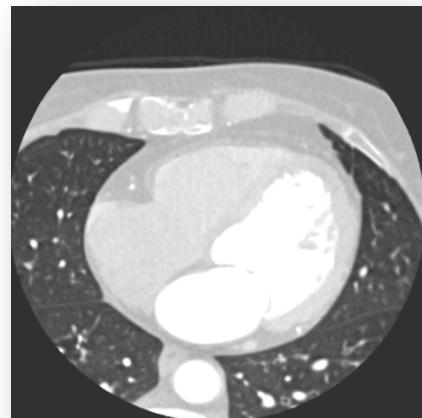
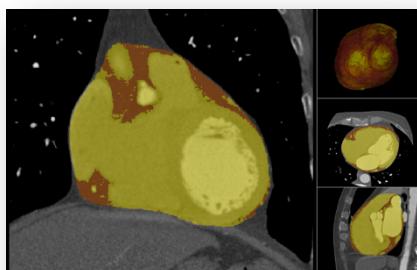
Adjust Window/Level

Click  and set the mediastinal window/level:



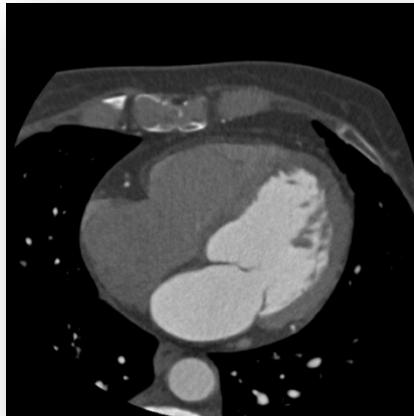
Click  and set the main view as the coronal image:

Click  and set the lung window/level:



Click  and set the main view as the 3D image:

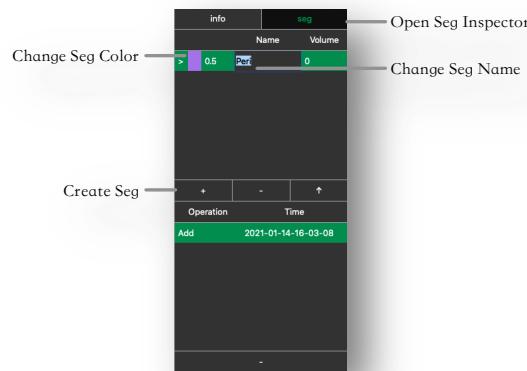
Click  and set the bone window/level:



Annotate Images

Create Seg

Create Seg in the Seg inspector, double-click the Name cell to change the Seg name. Double-click the color cell to select the Seg color.



Edit Seg

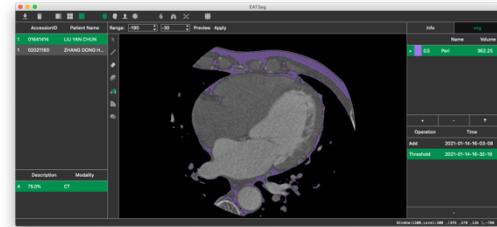
Choose the appropriate tool:

- to annotate the ROI. When using these three tools, , please set the appropriate parameters at first and press the **Preview** button to preview the segmentation result. If you are not satisfied with the result, press the **Preview** button again to cancel the preview. If you are satisfied with the result, press the **Apply** button to confirm.

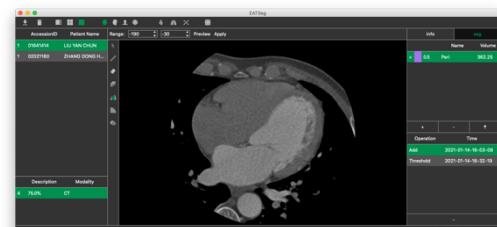
again to cancel the preview. If you are satisfied with the result, press the **Apply** button to confirm.

Note: Seg deletion and other operations cannot be performed before an operation is confirmed.

After confirming the segmentation result, the Step list will record the corresponding operation name and time, so that the user can go back to the modification history, as shown in the figure below:



The editing history of the Seg is recorded in the Step list: Add, Threshold. Click the entry in the Step list to return the Seg to the state of the corresponding operation. After the Add entry is selected as shown in the figure below, the Seg returns to the state before the threshold method segmentation:



Warning: Depending on whether EATSeg detects the available GPU and the performance of the corresponding hardware, the automatic pericardial segmentation tool may consume a lot of computing time. Do not close EATSeg before the automatic segmentation of the pericardium is completed, otherwise the database may be damaged.

Export Seg

Click the export button and select the file storage
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location, EATSeg will export the selected Seg and its corresponding image sequence in the .mha format.

info	seg
Name	Volume
> 0.5 Peri	362.25
+ - ↑	Export Seg
Operation	Time
Add	2021-01-14-16-03-08
Threshold	2021-01-14-16-32-19
-	