

# Support tool for image segmentation and mammogram analysis

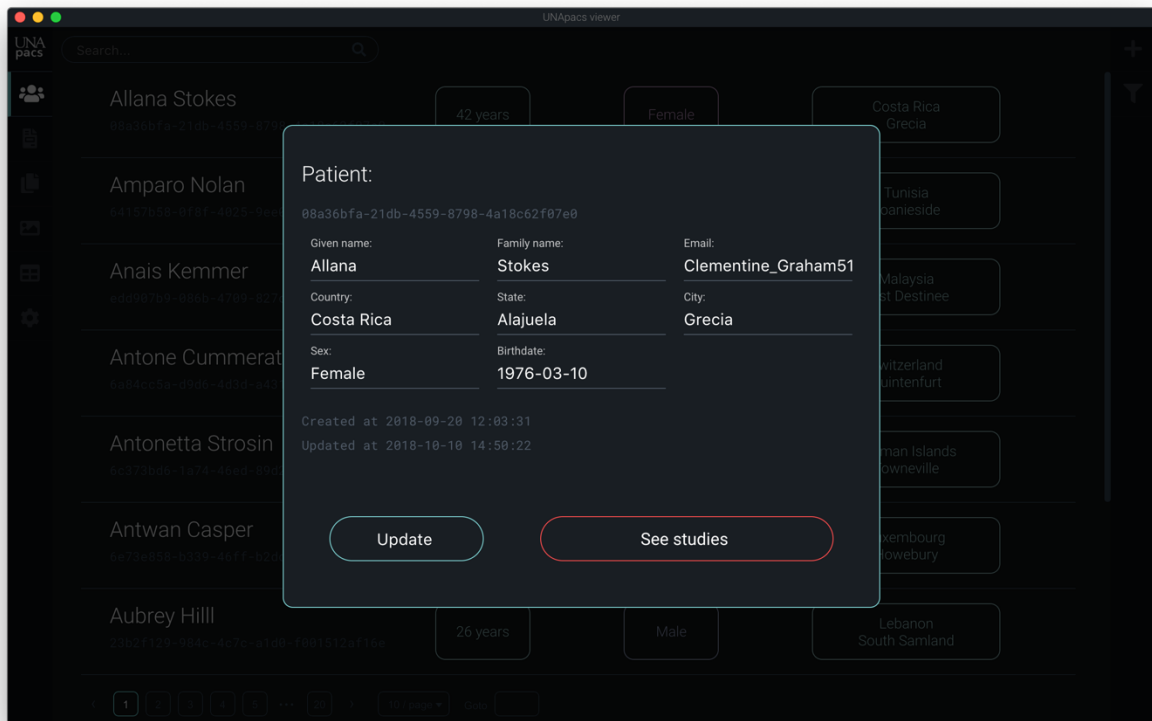
The UNApacs viewer is a graphical user interface (GUI) designed to explore a medical imaging database implemented with the pgcv extension. This viewer implements screens for exploring and manipulating patients, studies, series, instances and found regions in the images.

## Patient Screen

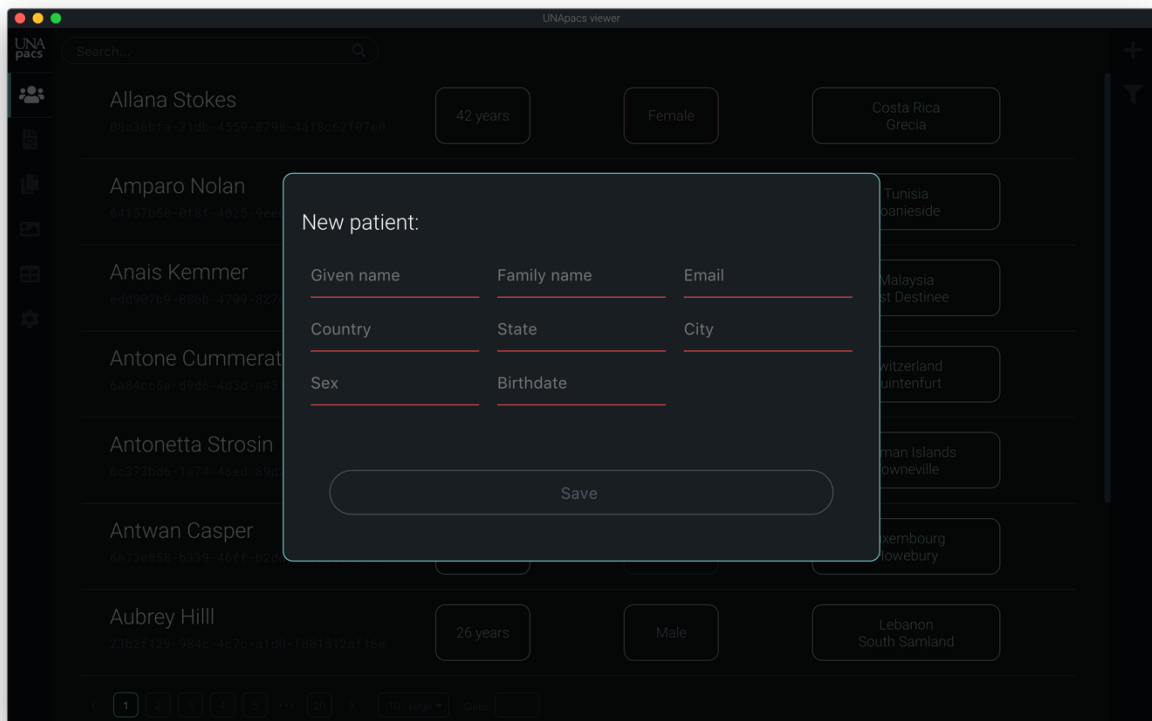
The patient screen shows the following patient information: patient name, *uuid*, age, sex and where is the patient from.

Search...				
Allana Stokes 08a36bfa-21db-4559-8798-4a18c62f07e0	42 years	Female	Costa Rica Grecia	
Amparo Nolan 64157b50-0f8f-4025-9ee0-fd4906861f06	47 years	N/A	Tunisia Joanieside	
Anais Kemmer edd907b9-086b-4709-827c-bcae7857b0f1	34 years	Not known	Malaysia East Destinee	
Antone Cummerata 6a84cc5a-d9d6-4d3d-a431-65e183685b81	28 years	N/A	Switzerland Quintenfurt	
Antonetta Strosin 6c373bd6-1a74-46ed-89d2-bcddb53021d8	25 years	Female	Cayman Islands Towneville	
Antwan Casper 6e73e858-b339-46ff-b2dd-630a5b54f960	50 years	Not known	Luxembourg Howebery	
Aubrey Hilll 23b2f129-984c-4c7c-a1d0-f001512af16e	26 years	Male	Lebanon South Samland	

From this screen is it possible to see a detailed view of the patient, including when it was last updated and to modify this entity. Note that is is also possible to navigate to that users' studies by clicking the "See studies" button.



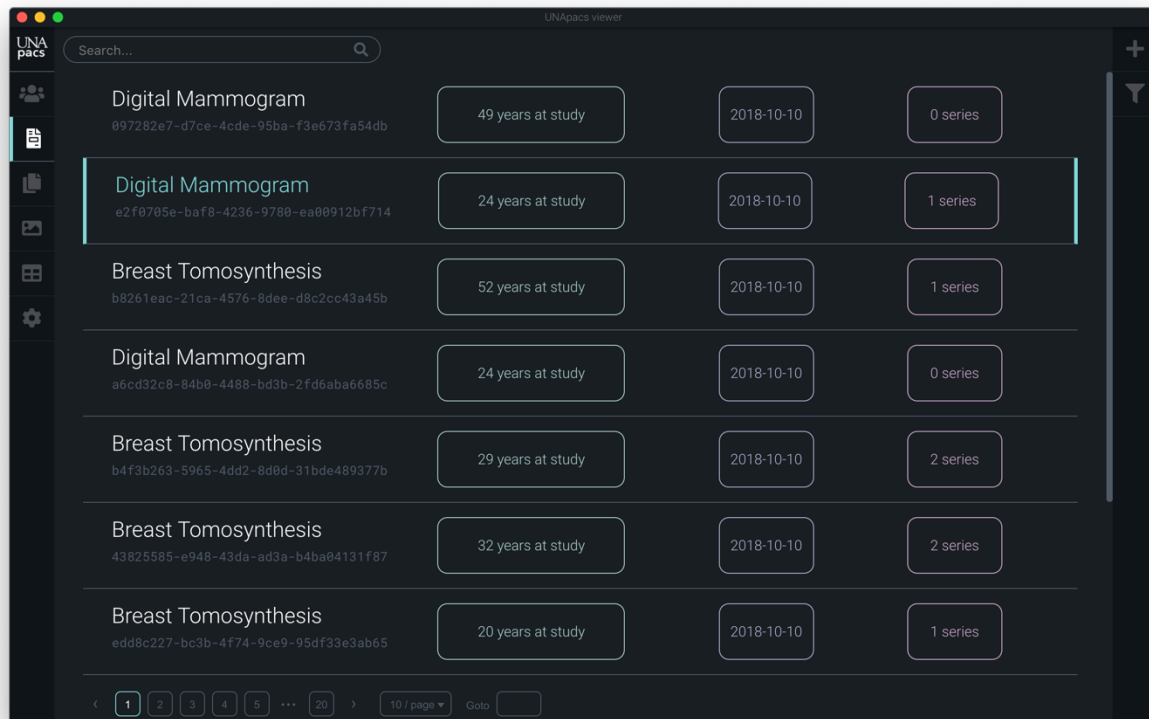
It is also possible to create a new patient by prompting the user for the data.



## Study Screen

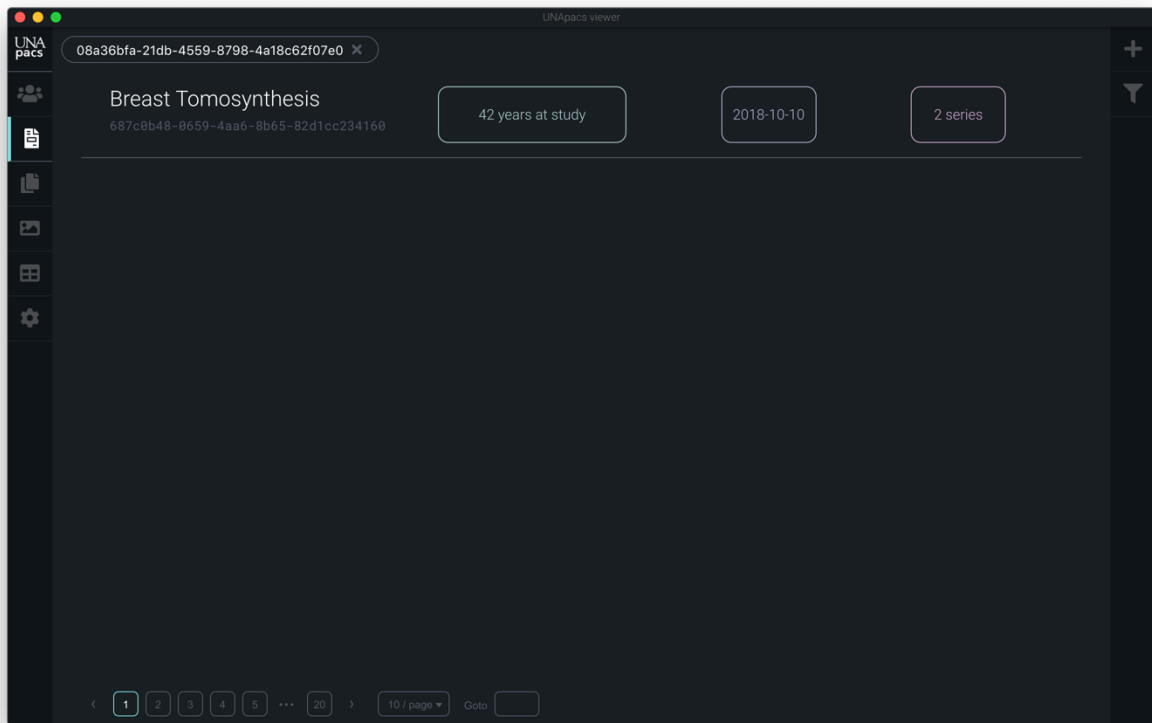
This screen shows the information about the study. The information shown is the study description, study uuid, years of the patient at the time of the study, date of the study and how many series the study has.

If the user navigated to this page using the “See studies” button, the search bar will be automatically updated with the *patient\_uuid*.

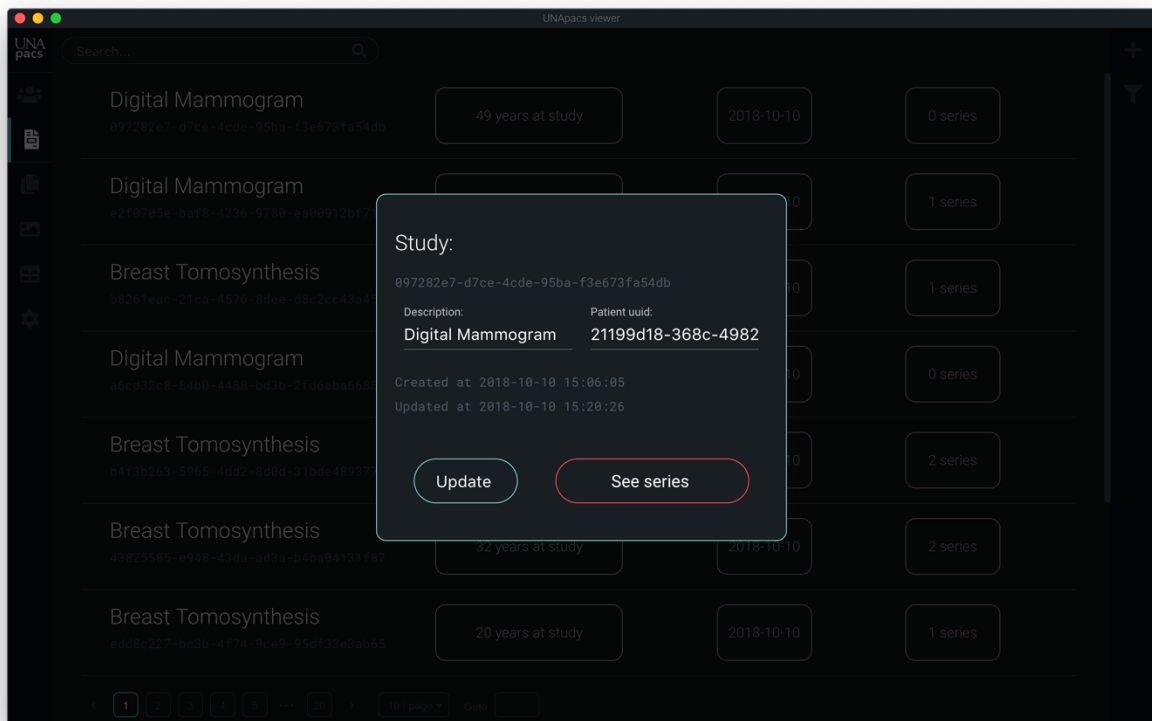


The screenshot shows the UNApacs viewer interface. At the top, there is a search bar with the text "Search...". Below the search bar, a list of studies is displayed. Each study entry consists of a study description, a study uuid, the patient's age at the time of the study, the date of the study, and the number of series. The second study in the list is highlighted with a blue border. At the bottom of the interface, there is a pagination bar showing the current page (1) and the total number of pages (20).

Study Description	Study UUID	Years at study	Date	Series
Digital Mammogram	097282e7-d7ce-4cde-95ba-f3e673fa54db	49 years at study	2018-10-10	0 series
Digital Mammogram	e2f0705e-baf8-4236-9780-ea00912bf714	24 years at study	2018-10-10	1 series
Breast Tomosynthesis	b8261eac-21ca-4576-8dee-d8c2cc43a45b	52 years at study	2018-10-10	1 series
Digital Mammogram	a6cd32c8-84b0-4488-bd3b-2fd6aba6685c	24 years at study	2018-10-10	0 series
Breast Tomosynthesis	b4f3b263-5965-4dd2-8d0d-31bde489377b	29 years at study	2018-10-10	2 series
Breast Tomosynthesis	43825585-e948-43da-ad3a-b4ba04131f87	32 years at study	2018-10-10	2 series
Breast Tomosynthesis	edd8c227-bc3b-4f74-9ce9-95df33e3ab65	20 years at study	2018-10-10	1 series

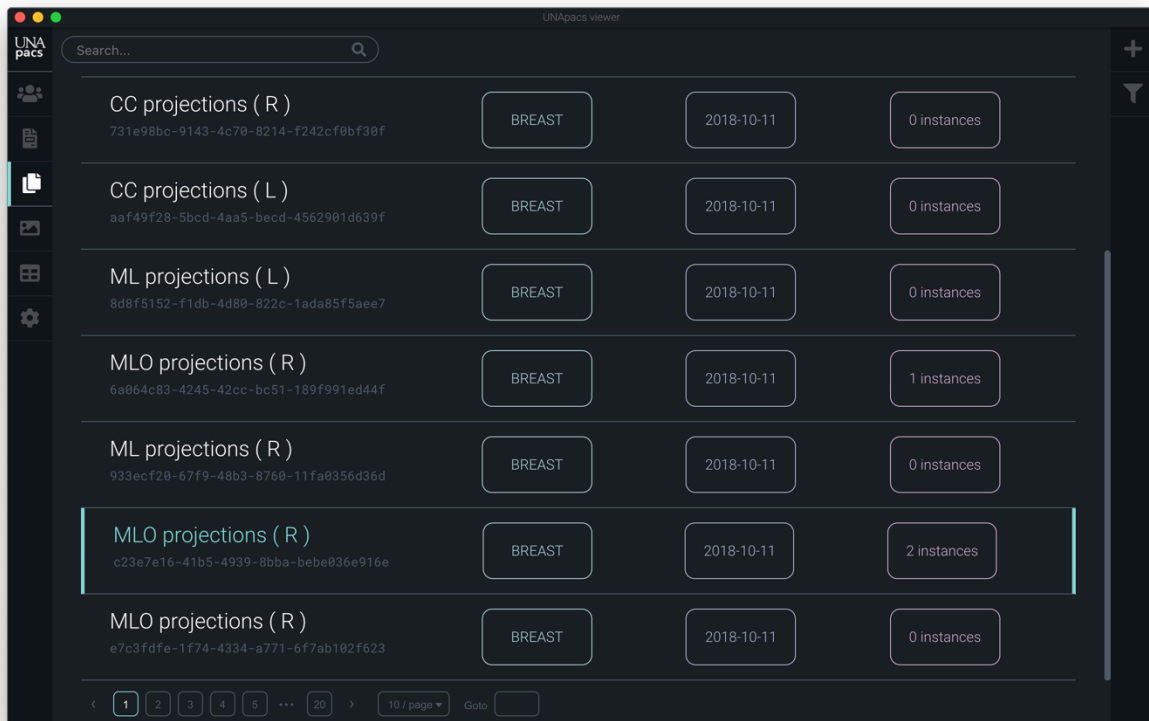


Clicking a study shows additional information such as the created and updated timestamps



## Series Screen

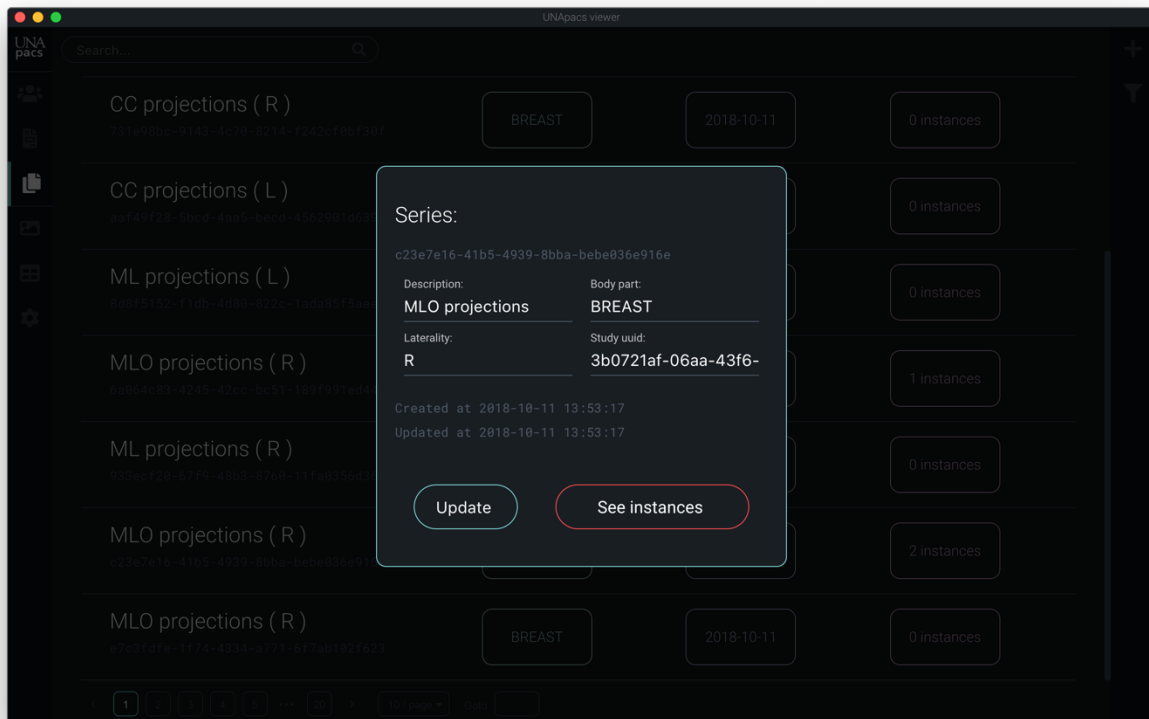
Similarly to the other screens, the series view shows information about the series of the studies. This view shows the series description, uuid, the laterality, the body part, date of the series and how many instances does that series has.



The screenshot shows the UNApacs viewer interface with a list of series. The interface includes a search bar, a sidebar with navigation icons, and a main table of series. The series are listed with their descriptions, UUIDs, body parts, laterality, dates, and instance counts. The fifth row, 'MLO projections (R)', is highlighted with a red border.

Series Description	UUID	Body Part	Laterality	Date	Instances
CC projections ( R )	731e98bc-9143-4c70-8214-f242cf0bf30f	BREAST		2018-10-11	0 instances
CC projections ( L )	aaf49f28-5bcd-4aa5-becd-4562901d639f	BREAST		2018-10-11	0 instances
ML projections ( L )	8d8f5152-f1db-4d80-822c-1ada85f5aee7	BREAST		2018-10-11	0 instances
MLO projections ( R )	6a064c83-4245-42cc-bc51-189f991ed44f	BREAST		2018-10-11	1 instances
ML projections ( R )	933ecf20-67f9-48b3-8760-11fa0356d36d	BREAST		2018-10-11	0 instances
MLO projections ( R )	c23e7e16-41b5-4939-8bba-bebe036e916e	BREAST		2018-10-11	2 instances
MLO projections ( R )	e7c3f0fe-1f74-4334-a771-6f7ab102f623	BREAST		2018-10-11	0 instances

Additional information can be seen by clicking on any of the items in the list



The screenshot shows the same series list as the previous image, but with a modal open for the selected series 'MLO projections (R)'. The modal displays the series UUID, description, body part, laterality, study UUID, creation and update timestamps, and two buttons: 'Update' and 'See instances'.

Series Description	UUID	Body Part	Laterality	Date	Instances
CC projections ( R )	731e98bc-9143-4c70-8214-f242cf0bf30f	BREAST		2018-10-11	0 instances
CC projections ( L )	aaf49f28-5bcd-4aa5-becd-4562901d639f	BREAST		2018-10-11	0 instances
ML projections ( L )	8d8f5152-f1db-4d80-822c-1ada85f5aee7	BREAST		2018-10-11	0 instances
MLO projections ( R )	6a064c83-4245-42cc-bc51-189f991ed44f	BREAST		2018-10-11	1 instances
ML projections ( R )	933ecf20-67f9-48b3-8760-11fa0356d36d	BREAST		2018-10-11	0 instances
MLO projections ( R )	c23e7e16-41b5-4939-8bba-bebe036e916e	BREAST		2018-10-11	2 instances
MLO projections ( R )	e7c3f0fe-1f74-4334-a771-6f7ab102f623	BREAST		2018-10-11	0 instances

Series:

c23e7e16-41b5-4939-8bba-bebe036e916e

Description: MLO projections Body part: BREAST

Laterality: R Study uuid: 3b0721af-06aa-43f6-

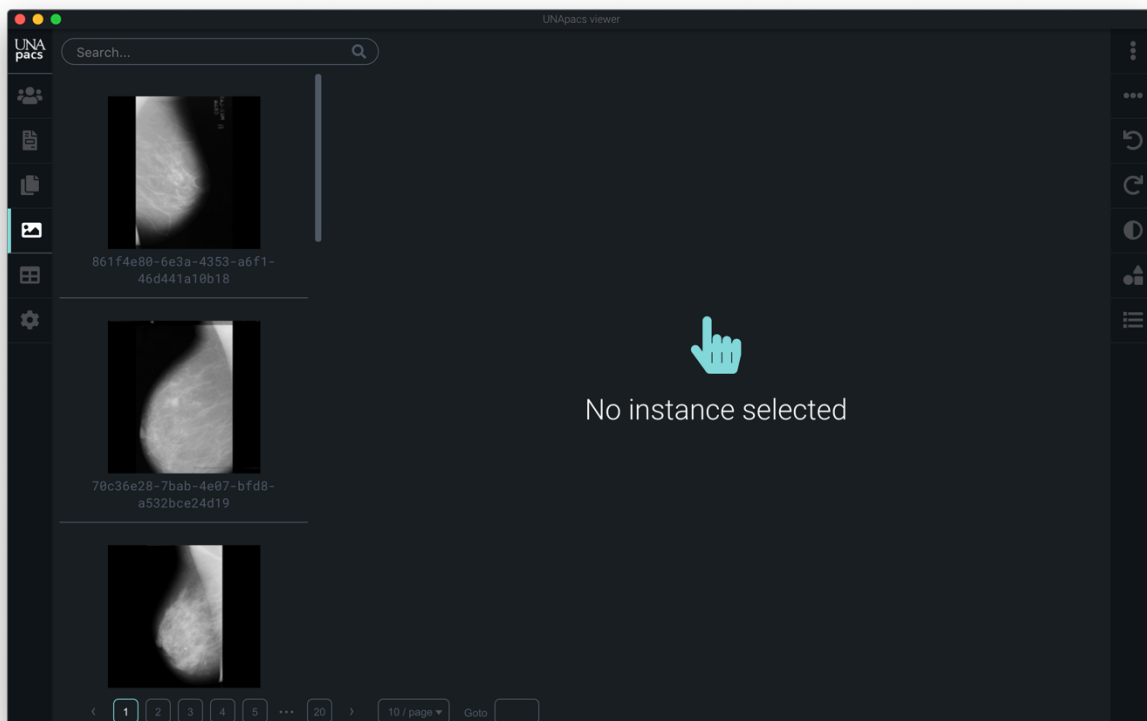
Created at 2018-10-11 13:53:17

Updated at 2018-10-11 13:53:17

Update See instances

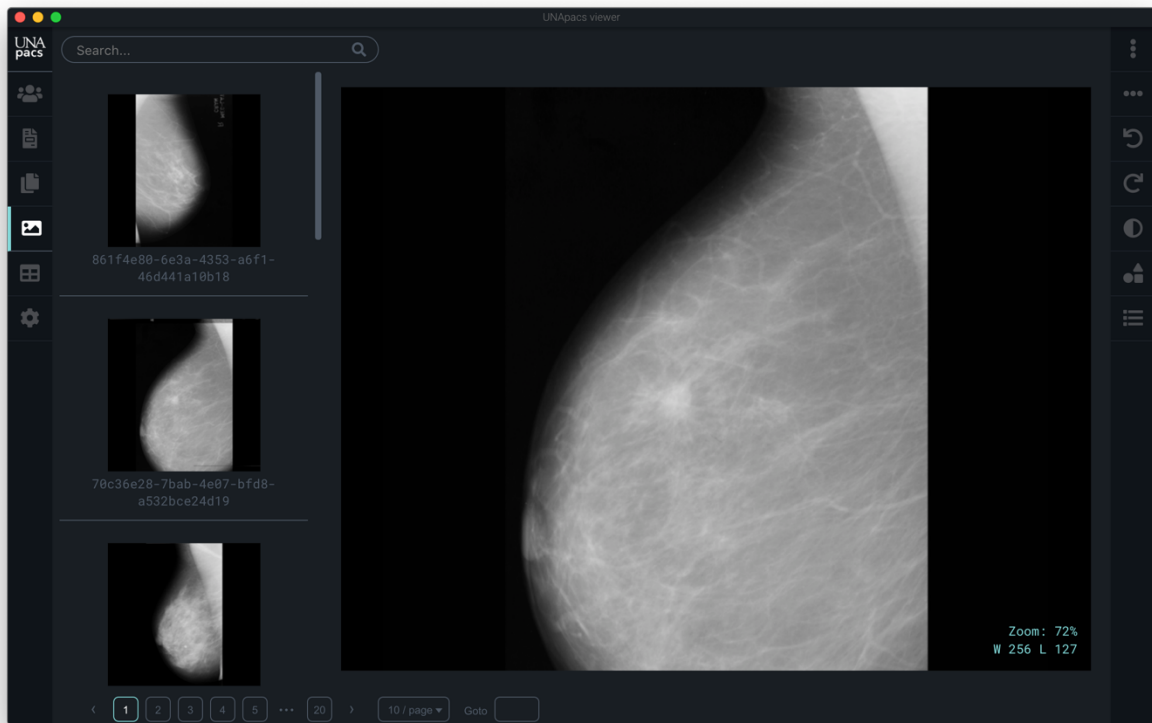
## Instance Screen

The instance screen initially loads the image thumbnails from a materialized view in the database. If the search bar is empty it will load all the thumbnails paginated, otherwise it will load the thumbnails of a series or instance uuid matching the search keyboard

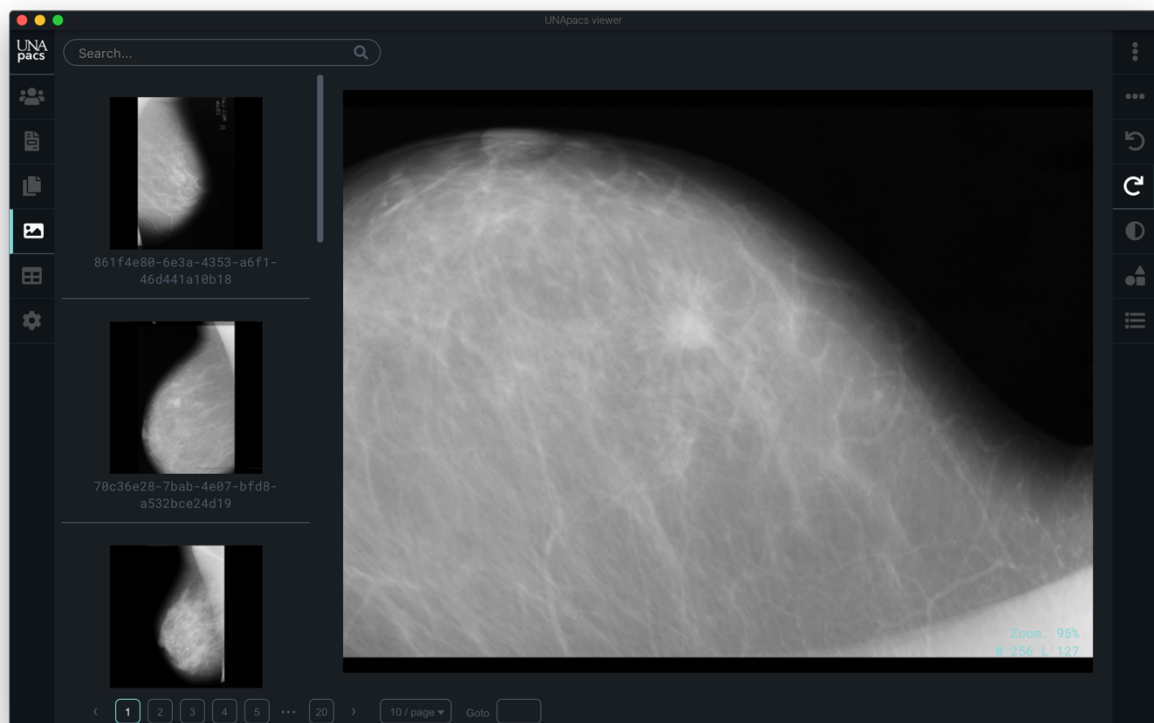
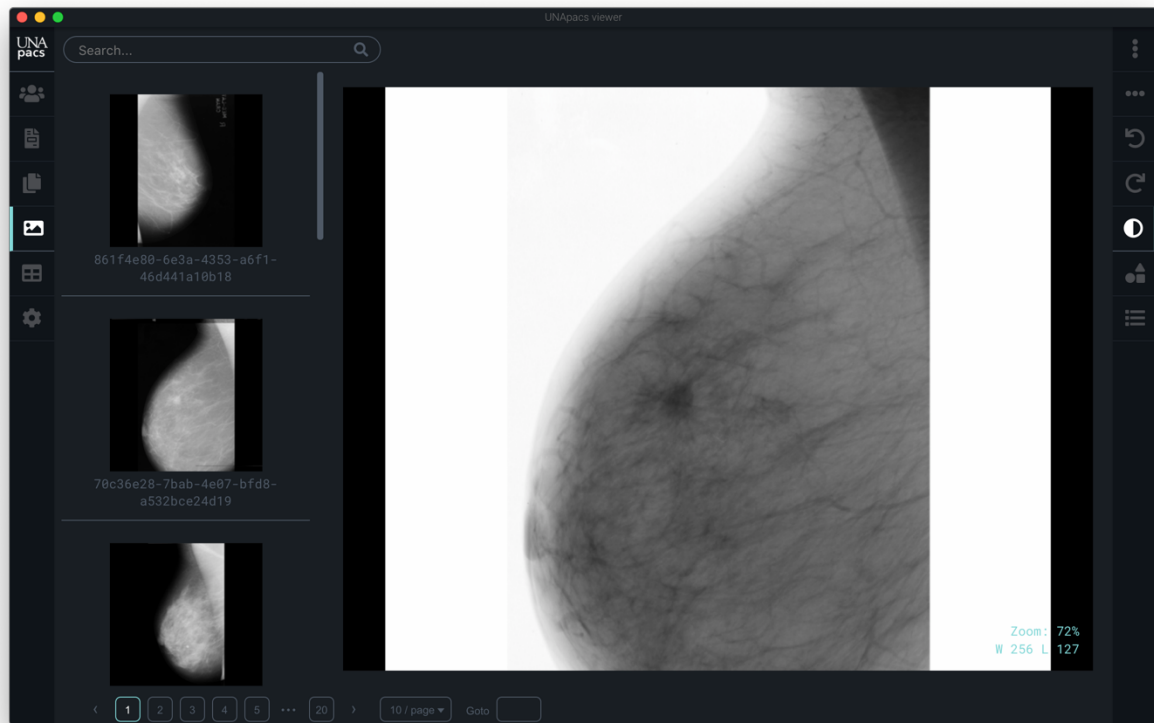


Once the user clicks on any of the thumbnails the full image will be queried from the database and displayed using the cornerstone library.

This allows the user to adjust the brightness and contrast using the mouse and performing zooming and panning with the image

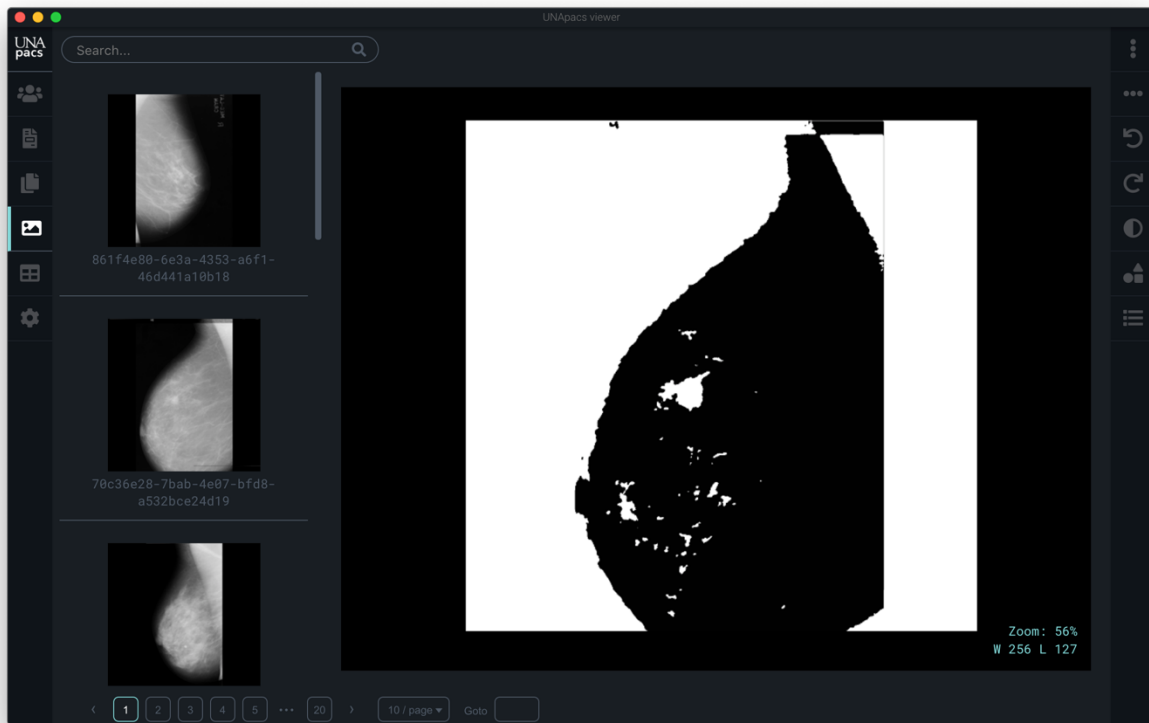


In the right side there are additional tools, such as Vertical/Horizontal Flip, Left/Right Rotate and invert



The sixth option in this side menu queries the segmented image using the *pgcv* extension.





The last option redirects to the Region Screen, which shows the regions found in the segmented image.

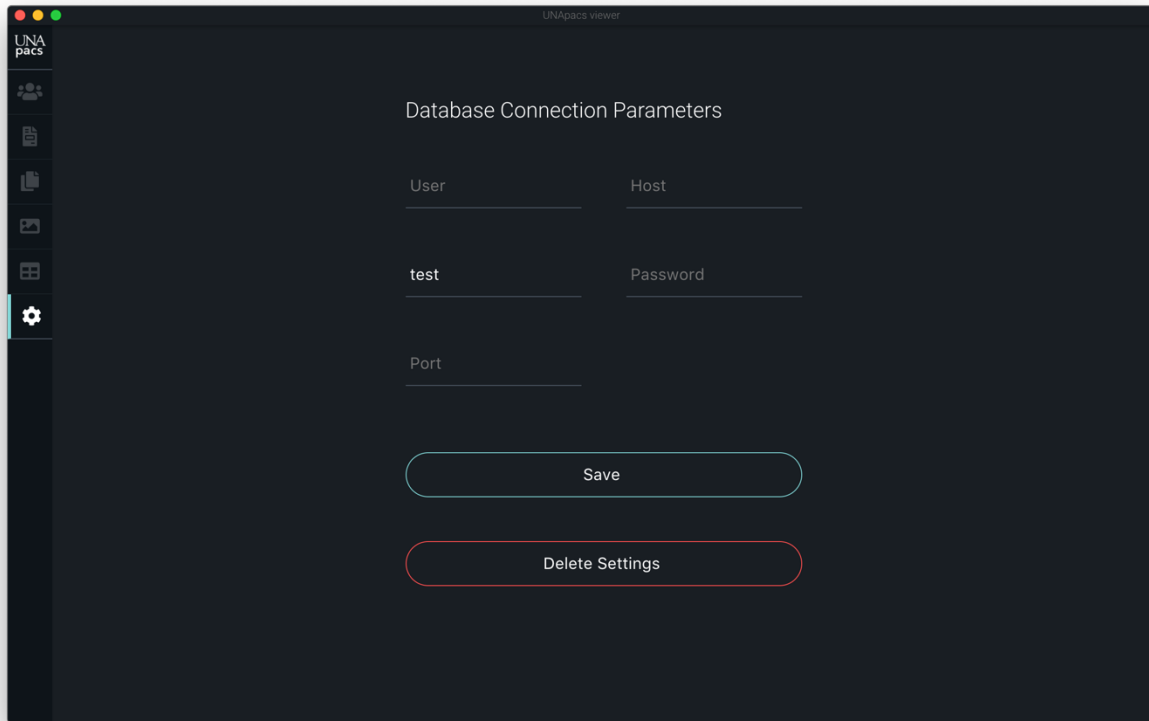
## Region Screen

Label	Instance	Area	Perimeter	Solity	Centroid
OTSU ENHANCEMENT ( label 2 )	70c36e28-7bab-4e07-bfd8-a532bce24d19	16264	710	0.9229	(112, 794)
OTSU ENHANCEMENT ( label 3 )	70c36e28-7bab-4e07-bfd8-a532bce24d19	49	32	0.7206	(287, 833)
OTSU ENHANCEMENT ( label 4 )	70c36e28-7bab-4e07-bfd8-a532bce24d19	12	10	0.9231	(299, 833)
OTSU ENHANCEMENT ( label 5 )	70c36e28-7bab-4e07-bfd8-a532bce24d19	10	9	1.0000	(420, 428)
OTSU ENHANCEMENT ( label 6 )	70c36e28-7bab-4e07-bfd8-a532bce24d19	229	95	0.6206	(427, 446)
OTSU ENHANCEMENT ( label 7 )	70c36e28-7bab-4e07-bfd8-a532bce24d19	29	17	0.9667	(474, 481)
OTSU ENHANCEMENT ( label 8 )	70c36e28-7bab-4e07-bfd8-a532bce24d19	101	51	0.8016	(479, 504)

The region screen shows the properties of the regions found in the segmented mammogram. This list shows the method used to extract the regions, the label of the region, the instance to which the region belongs, the area, perimeter, solidity and centroid of the region.

## Settings Screen

Lastly, the settings screen allows the user to configure the connection parameters to the database. After connecting, the viewer checks that the database contains the needed tables. If the process succeeds, the user will be redirected to the Patient Screen



The screenshot shows the 'UNApacs viewer' application window. On the left is a dark sidebar with a vertical list of icons: a group of people, a document, a folder, a camera, a grid, and a gear (selected). The main area is titled 'Database Connection Parameters' and contains four input fields: 'User' (with 'test' entered), 'Host', 'Password', and 'Port'. At the bottom are two buttons: 'Save' and 'Delete Settings'.

Database Connection Parameters	
User	Host
test	Password
Port	
Save	
Delete Settings	