LIFEx v7.2.0

Announcement

— LIFEx —

C. Nioche, O. Lamer, I. Buvat

What is new?

LIFEx version 7.2.0
Last update of document: 2022/03/21

CONTENTS

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— LIFEx —

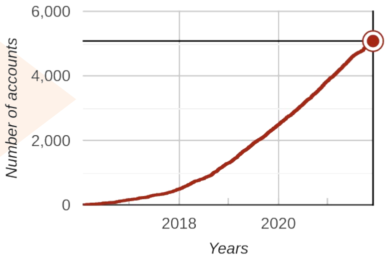
Acknowledgements

Dear LIFEx users,

We are pleased to announce the release of **LIFEx v7.2.0**

We would like to take this opportunity **to thank all 5.000 LIFEx users** for their feedback and relevant suggestions. We took into account your comments to enhance the software and produce this version.
We hope you will enjoy it.

Do not hesitate to download this new release and replace your old LIFEx version. Your feedback will always be welcome.

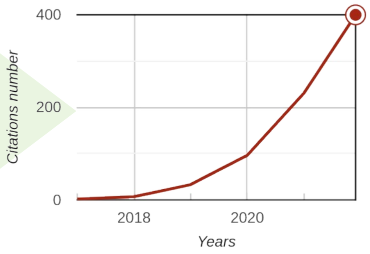


Evolution of the number of accounts
(from our site web)

LIFEx is free of charge.

Please help us to keep it free by always quoting the LIFEx reference: (see below)

Please note that the correct reference to be cited is:
C Nioche, F Orlhac, S Boughdad, S Reuzé, J Goya-Outi, C Robert, C Pellot-Barakat, M Soussan, F Frouin, and I Buvat. LIFEx: a freeware for radiomic feature calculation in multimodality imaging to accelerate advances in the characterization of tumor heterogeneity. Cancer Research 2018; 78(16):4786-4789



Evolution of the number of citing LIFEx
(from PubMed)

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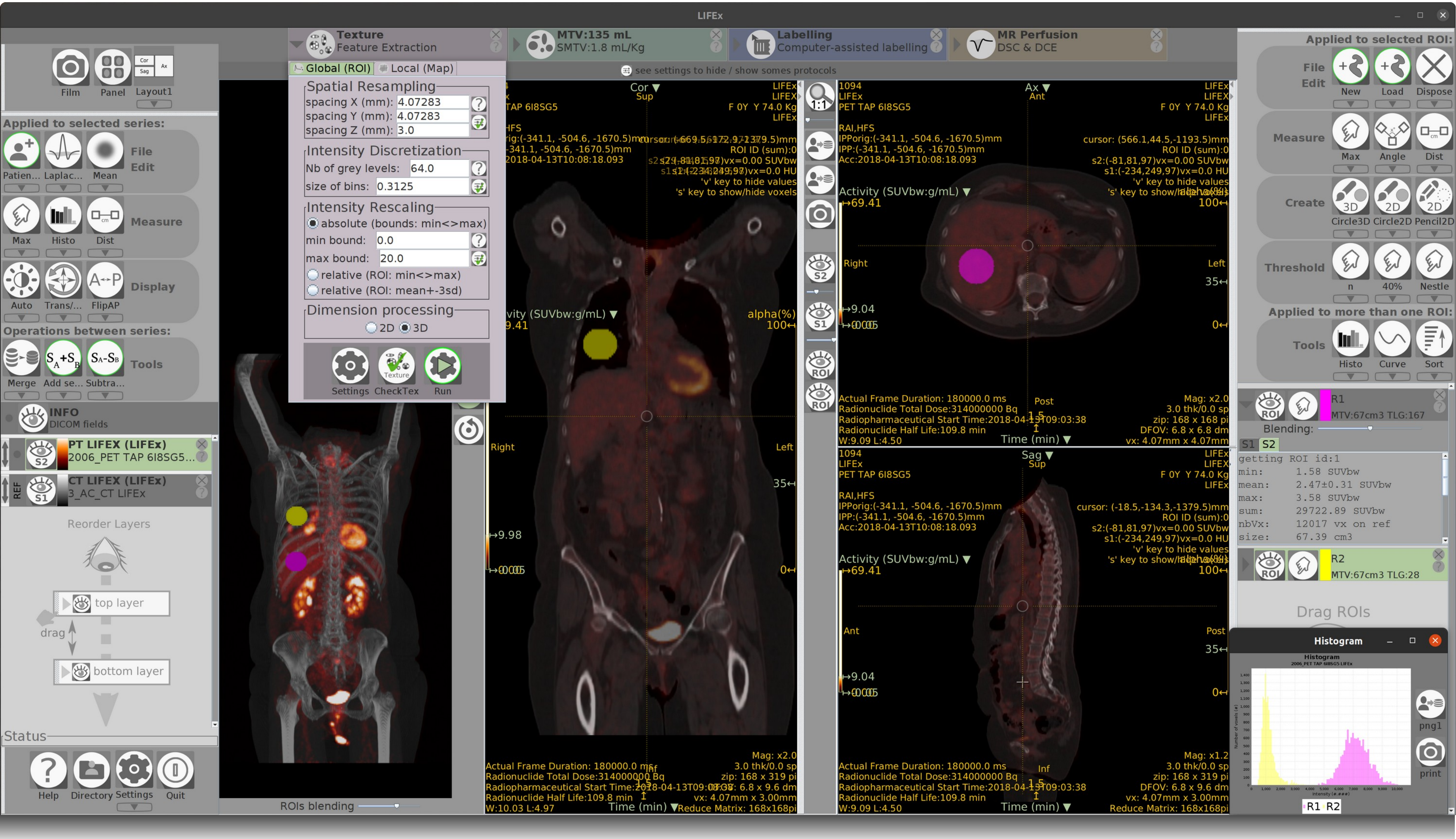
Annoucement

— LIFEx —

Interface screenshot



Texture Feature Extraction

Global (ROI) | Local (Map)

Spatial Resampling
spacing X (mm): 4.07283
spacing Y (mm): 4.07283
spacing Z (mm): 3.0

Intensity Discretization
Nb of grey levels: 64.0
size of bins: 0.3125

Intensity Rescaling
● absolute (bounds: min<>max)
min bound: 0.0
max bound: 20.0
○ relative (ROI: min<>max)
○ relative (ROI: mean+-3sd)

Dimension processing
○ 2D ● 3D

R1 MTV:67cm3 TLG:167

```
getting ROI id:1
min:       1.58 SUVbw
mean:      2.47±0.31 SUVbw
max:       3.58 SUVbw
sum:       29722.89 SUVbw
nbVx:      12017 vx on ref
size:      67.39 cm3
```

R2 MTV:67cm3 TLG:28

LITO

The Laboratory of Translational Imaging in Oncology is a mixed research unit supported by Inserm (=French NIH) and Institut Curie, the 1st cancer center in France.

LIFEx v7.2.0

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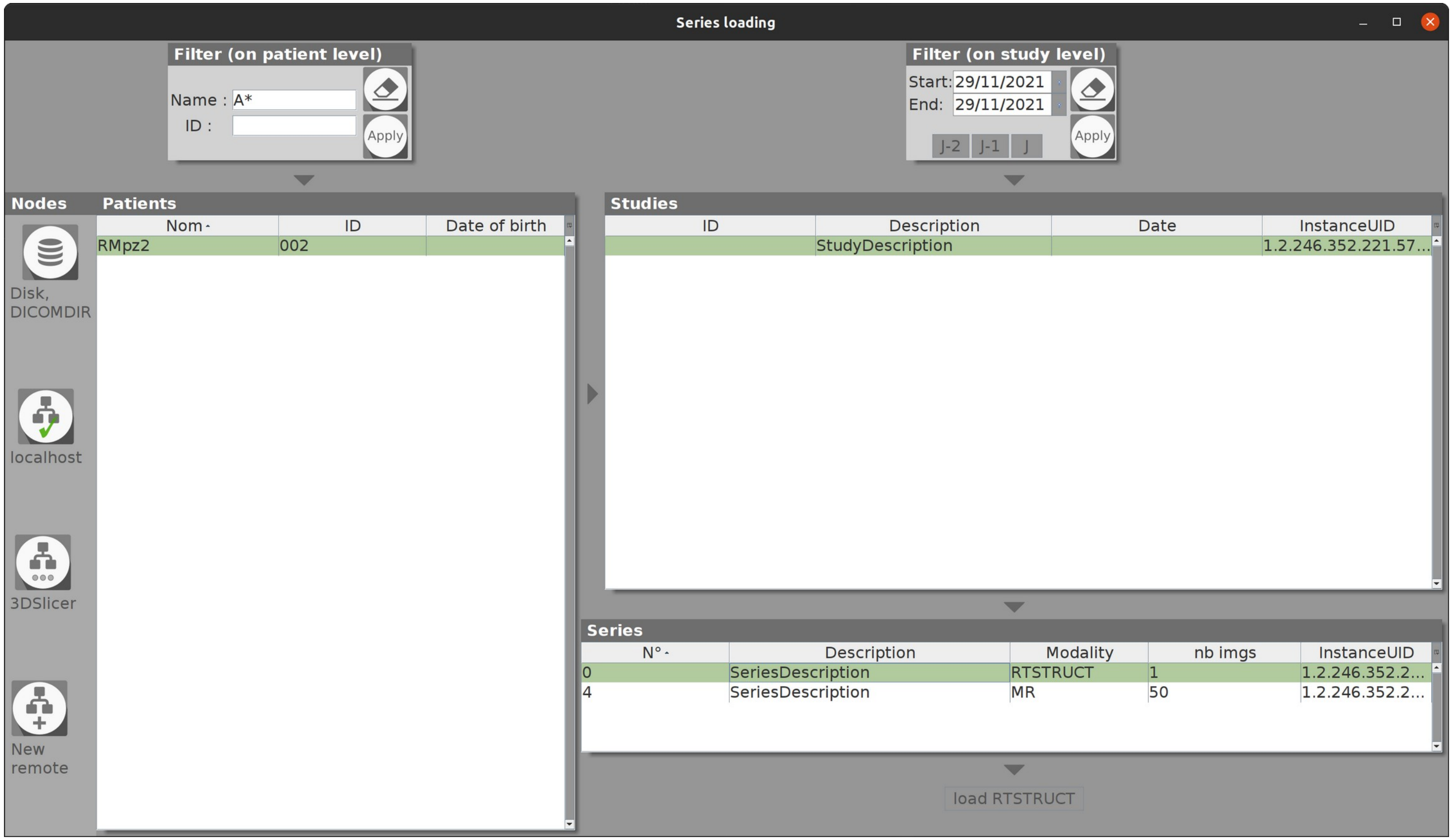
Main updates

C. Nioche

Series:

- added: reading of the RT-Struct with the DICOM browser



Name : A*

ID :

Start: 29/11/2021

End: 29/11/2021

Nom	ID	Date of birth
RMpz2	002	

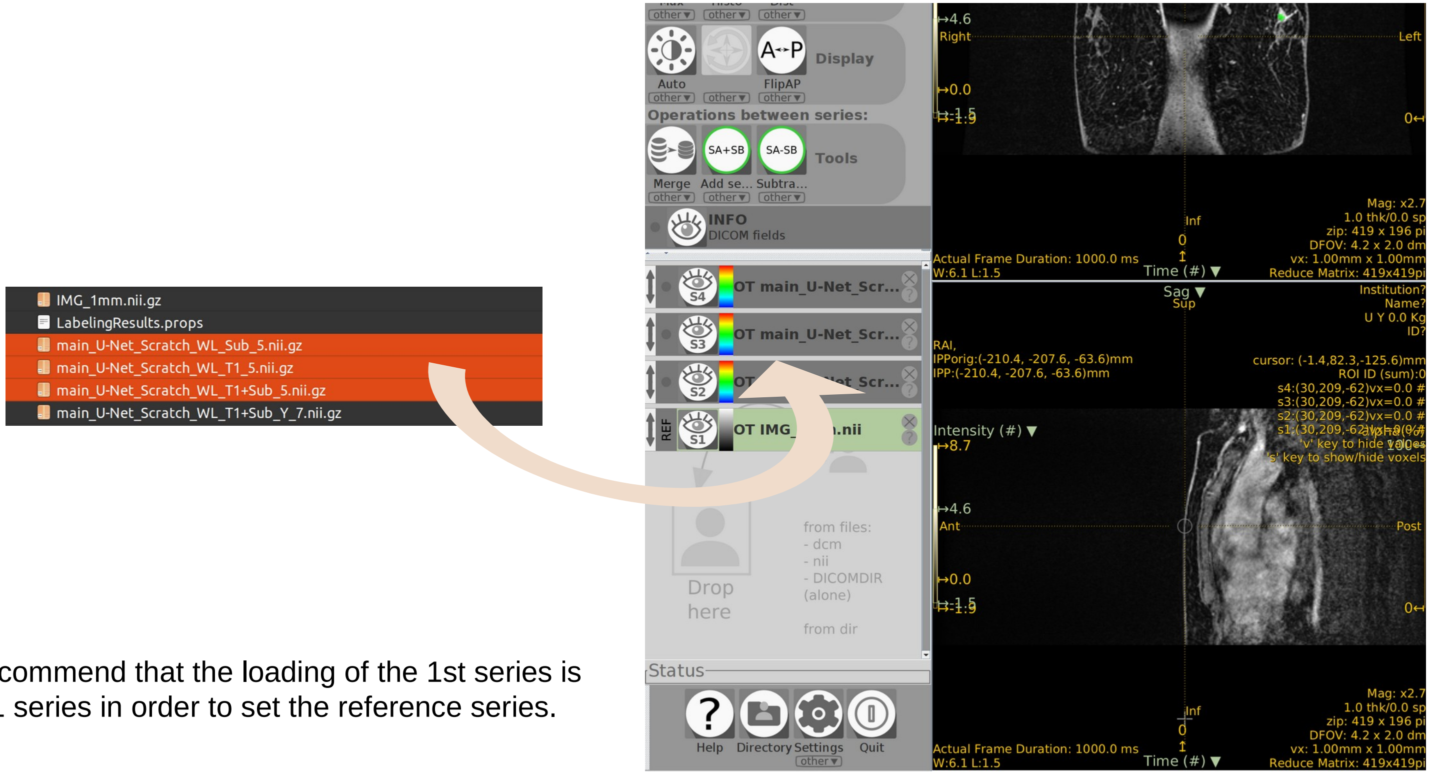
ID	Description	Date	InstanceUID
	StudyDescription		1.2.246.352.221.57...

N°	Description	Modality	nb imgs	InstanceUID
0	SeriesDescription	RTSTRUCT	1	1.2.246.352.2...
4	SeriesDescription	MR	50	1.2.246.352.2...

Series updates

C. Nioche

Series:
added: loading more than one series (in nifti format) using a single "drag and drop"


IMG_1mm.nii.gz
LabelingResults.props
main_U-Net_Scratch_WL_Sub_5.nii.gz
main_U-Net_Scratch_WL_T1_5.nii.gz
main_U-Net_Scratch_WL_T1+Sub_5.nii.gz
main_U-Net_Scratch_WL_T1+Sub_Y_7.nii.gz

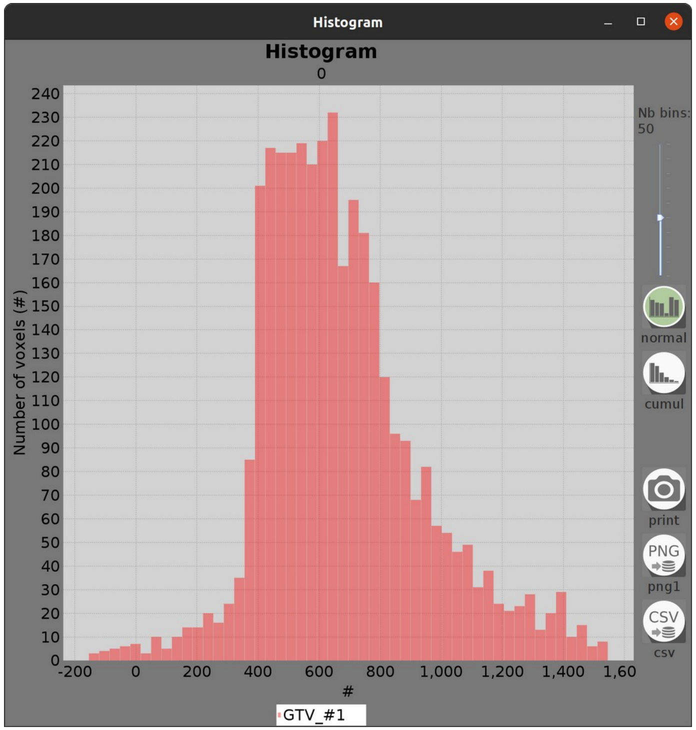
Attention, we recommend that the loading of the 1st series is done with only 1 series in order to set the reference series.

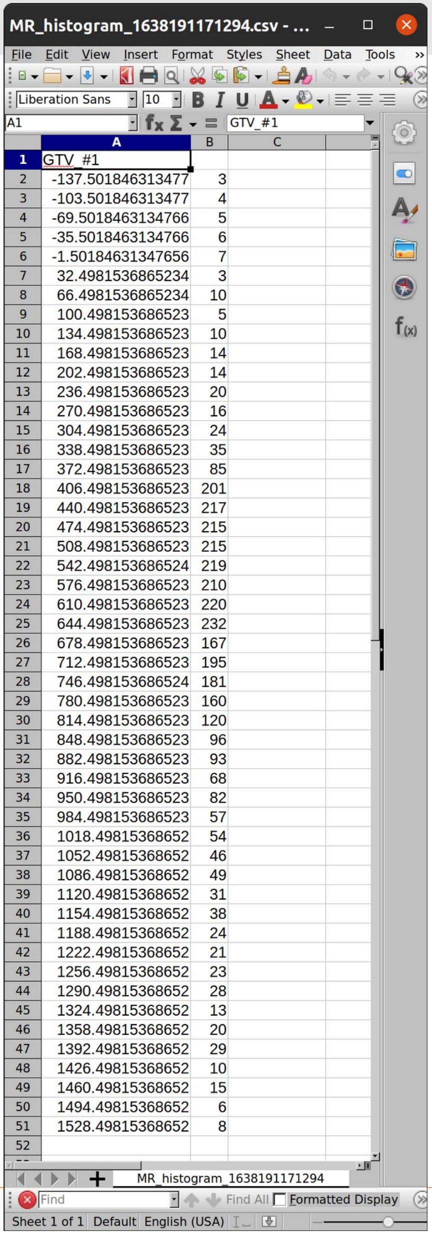
Main updates

C. Nioche

Series:

- added: saving of histogram data in .csv format





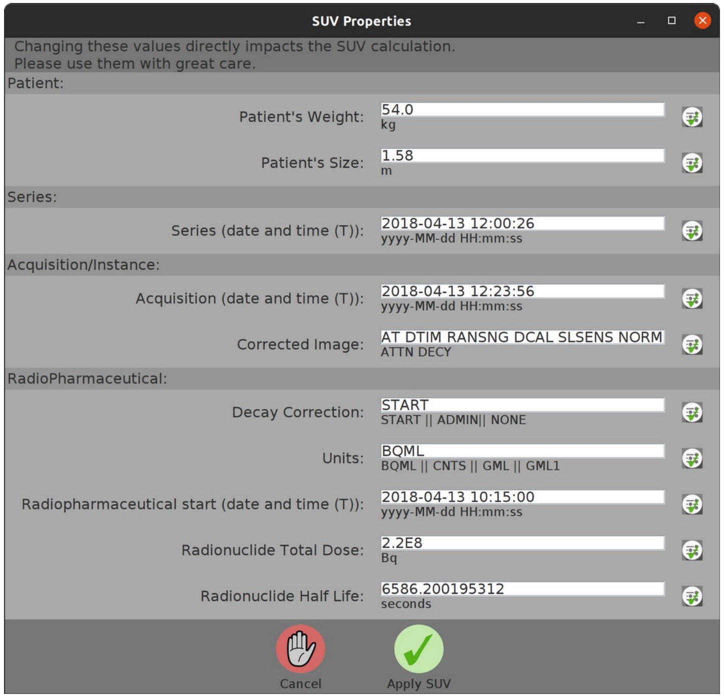
	A	B	C
1	GTV_#1		
2	-137.501846313477	3	
3	-103.501846313477	4	
4	-69.5018463134766	5	
5	-35.5018463134766	6	
6	-1.50184631347656	7	
7	32.4981536865234	3	
8	66.4981536865234	10	
9	100.498153686523	5	
10	134.498153686523	10	
11	168.498153686523	14	
12	202.498153686523	14	
13	236.498153686523	20	
14	270.498153686523	16	
15	304.498153686523	24	
16	338.498153686523	35	
17	372.498153686523	85	
18	406.498153686523	201	
19	440.498153686523	217	
20	474.498153686523	215	
21	508.498153686523	215	
22	542.498153686524	219	
23	576.498153686523	210	
24	610.498153686523	220	
25	644.498153686523	232	
26	678.498153686523	167	
27	712.498153686523	195	
28	746.498153686524	181	
29	780.498153686523	160	
30	814.498153686523	120	
31	848.498153686523	96	
32	882.498153686523	93	
33	916.498153686523	68	
34	950.498153686523	82	
35	984.498153686523	57	
36	1018.49815368652	54	
37	1052.49815368652	46	
38	1086.49815368652	49	
39	1120.49815368652	31	
40	1154.49815368652	38	
41	1188.49815368652	24	
42	1222.49815368652	21	
43	1256.49815368652	23	
44	1290.49815368652	28	
45	1324.49815368652	13	
46	1358.49815368652	20	
47	1392.49815368652	29	
48	1426.49815368652	10	
49	1460.49815368652	15	
50	1494.49815368652	6	
51	1528.49815368652	8	
52			

Series updates

C. Nioche

Series:

- changed: SUV is not required for Nuclear Medicine images (avoids the warning SUV conversion error)
- added: SUV property form to modify SUV calculation values



SUV Properties

Changing these values directly impacts the SUV calculation.
Please use them with great care.

Patient:

Patient's Weight:	54.0	kg
Patient's Size:	1.58	m

Series:

Series (date and time (T)):	2018-04-13 12:00:26	yyyy-MM-dd HH:mm:ss

Acquisition/Instance:

Acquisition (date and time (T)):	2018-04-13 12:23:56	yyyy-MM-dd HH:mm:ss
Corrected Image:	AT DTIM RANSNG DCAL SLSENS NORM	ATTN DECY

RadioPharmaceutical:

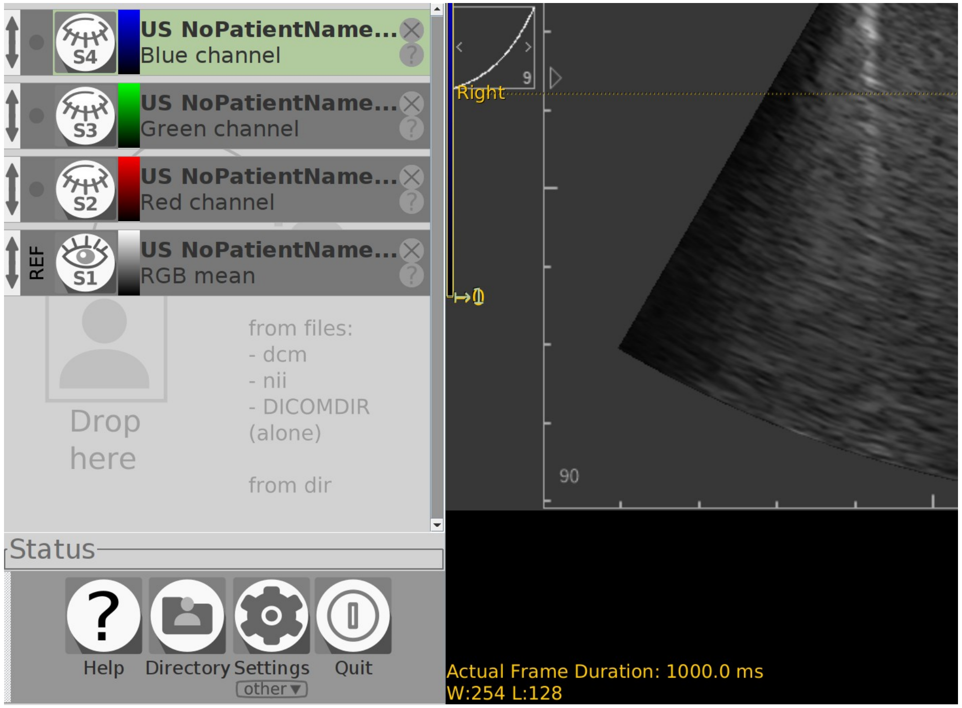
Decay Correction:	START	START || ADMIN|| NONE
Units:	BQML	BQML || CNTS || GML || GML1
Radiopharmaceutical start (date and time (T)):	2018-04-13 10:15:00	yyyy-MM-dd HH:mm:ss
Radionuclide Total Dose:	2.2E8	Bq
Radionuclide Half Life:	6586.200195312	seconds

Series updates

C. Nioche

Series:

- added red, green and blue channel decomposition from US modalities



US NoPatientName… Blue channel

US NoPatientName… Green channel

US NoPatientName… Red channel

US NoPatientName… RGB mean

Actual Frame Duration: 1000.0 ms
W:254 L:128

Series updates

C. Nioche

Series:

- added: de-synchronization of the MIP colour palette versus 2D colour palettes

MIP with gray colour palette

Series updates

C. Nioche

Series:
- added: Script loading-saving of Series

or how to convert dicom to nifti (Dcm2Nii)

```
# Name of script
LIFEx.Type=ScriptLoadingSavingOfSeries


################################
# Output part

# Output directory (keep empty, for keep same input directory)
LIFEx.Output.Directory=/Users/outputDirectory

# format of output files [  nii  ]
LIFEx.Output.FileFormat=nii

# type of output files [  int16  ||  float32  ]
LIFEx.Output.FileType=int16

# dimension of output images [  tzyx=4D  ||  zyx=3D  ||  yx=2D  ]
LIFEx.Output.Run0=tzyx
LIFEx.Output.Run1=zyx
LIFEx.Output.Run2=yx
```

```
################################
# Input part

# Image orientation patient: [  enable || disable  ]
LIFEx.Input.IOP = disable

# Image position patient: [  enable || disable  ]
LIFEx.Input.IPP = enable

# reading file (or directory that include images)
LIFEx.Input.Img0=/Users/inputDirectory
```

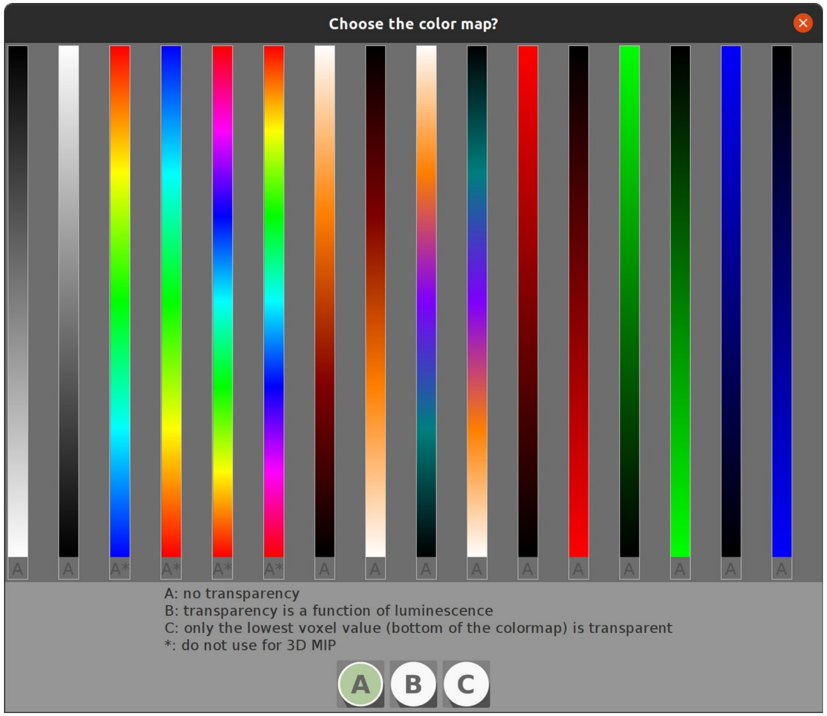
Series updates

C. Nioche

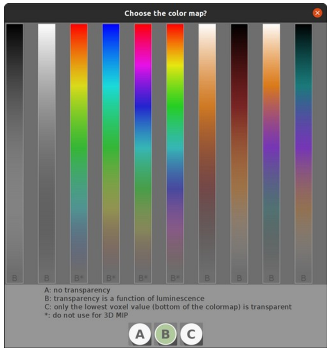
Series:

- changed: color map selector frame
- added: Warm Metal, red, green, blue color maps on series

Warm Metal



A: no transparency
B: transparency is a function of luminescence
C: only the lowest voxel value (bottom of the colormap) is transparent
*: do not use for 3D MIP



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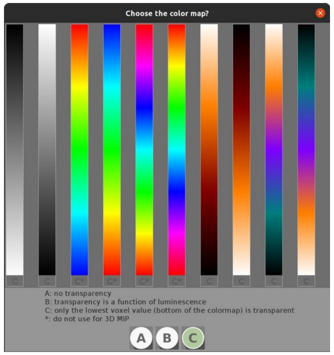


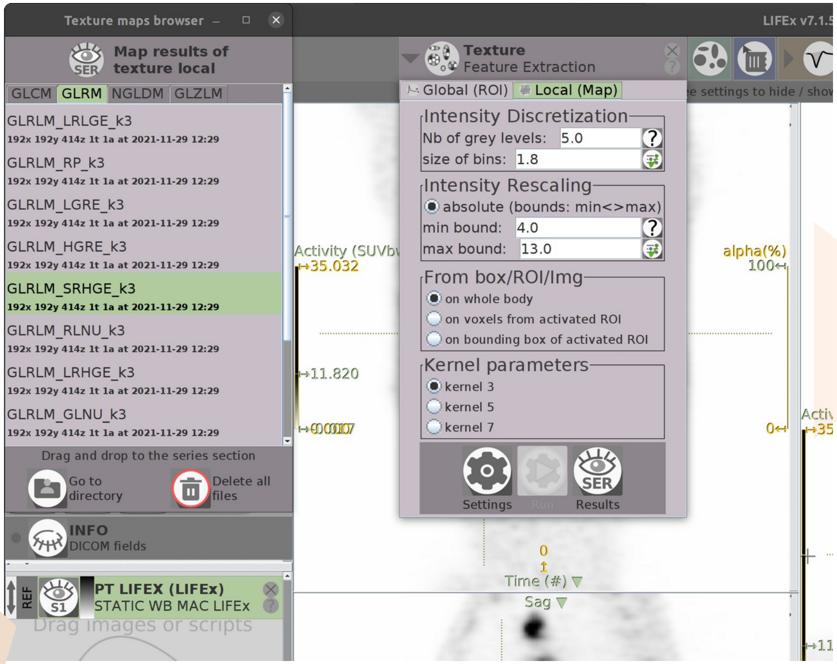
A: no transparency
B: transparency is a function of luminescence
C: only the lowest voxel value (bottom of the colormap) is transparent
*: do not use for 3D MIP

Protocol updates

C. Nioche

Texture protocol:

- new GUI for management of texture local (map) results
- new texture local (map) results : GLCM, GLRM, NGDLM



GLRLM_LRLGE_k3
192x 192y 414z 1t 1a at 2021-11-29 12:29
GLRLM_RP_k3
192x 192y 414z 1t 1a at 2021-11-29 12:29
GLRLM_LGRE_k3
192x 192y 414z 1t 1a at 2021-11-29 12:29
GLRLM_HGRE_k3
192x 192y 414z 1t 1a at 2021-11-29 12:29
GLRLM_SRHGE_k3
192x 192y 414z 1t 1a at 2021-11-29 12:29
GLRLM_RLNU_k3
192x 192y 414z 1t 1a at 2021-11-29 12:29
GLRLM_LRHGE_k3
192x 192y 414z 1t 1a at 2021-11-29 12:29
GLRLM_GLNU_k3
192x 192y 414z 1t 1a at 2021-11-29 12:29

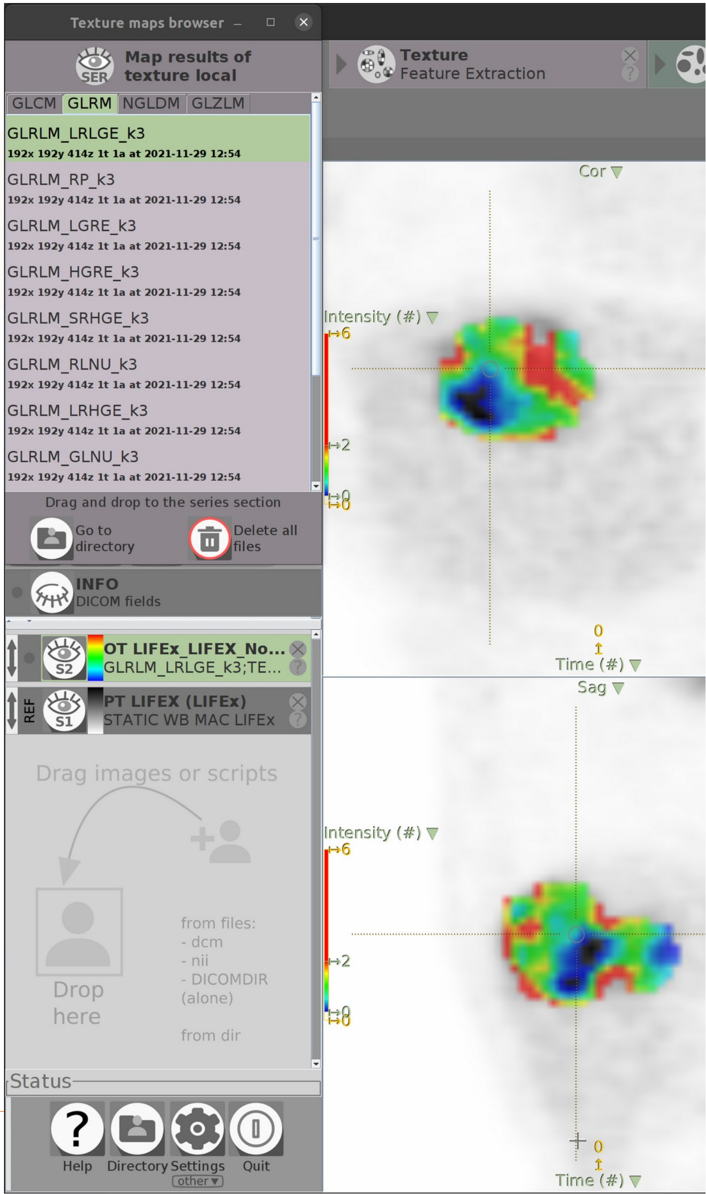
Intensity Discretization
Nb of grey levels: 5.0
size of bins: 1.8

Intensity Rescaling
● absolute (bounds: min<>max)
min bound: 4.0
max bound: 13.0

From box/ROI/Img
● on whole body
○ on voxels from activated ROI
○ on bounding box of activated ROI

Kernel parameters
● kernel 3
○ kernel 5
○ kernel 7

Drag and drop



GLRLM_LRLGE_k3
192x 192y 414z 1t 1a at 2021-11-29 12:54
GLRLM_RP_k3
192x 192y 414z 1t 1a at 2021-11-29 12:54
GLRLM_LGRE_k3
192x 192y 414z 1t 1a at 2021-11-29 12:54
GLRLM_HGRE_k3
192x 192y 414z 1t 1a at 2021-11-29 12:54
GLRLM_SRHGE_k3
192x 192y 414z 1t 1a at 2021-11-29 12:54
GLRLM_RLNU_k3
192x 192y 414z 1t 1a at 2021-11-29 12:54
GLRLM_LRHGE_k3
192x 192y 414z 1t 1a at 2021-11-29 12:54
GLRLM_GLNU_k3
192x 192y 414z 1t 1a at 2021-11-29 12:54

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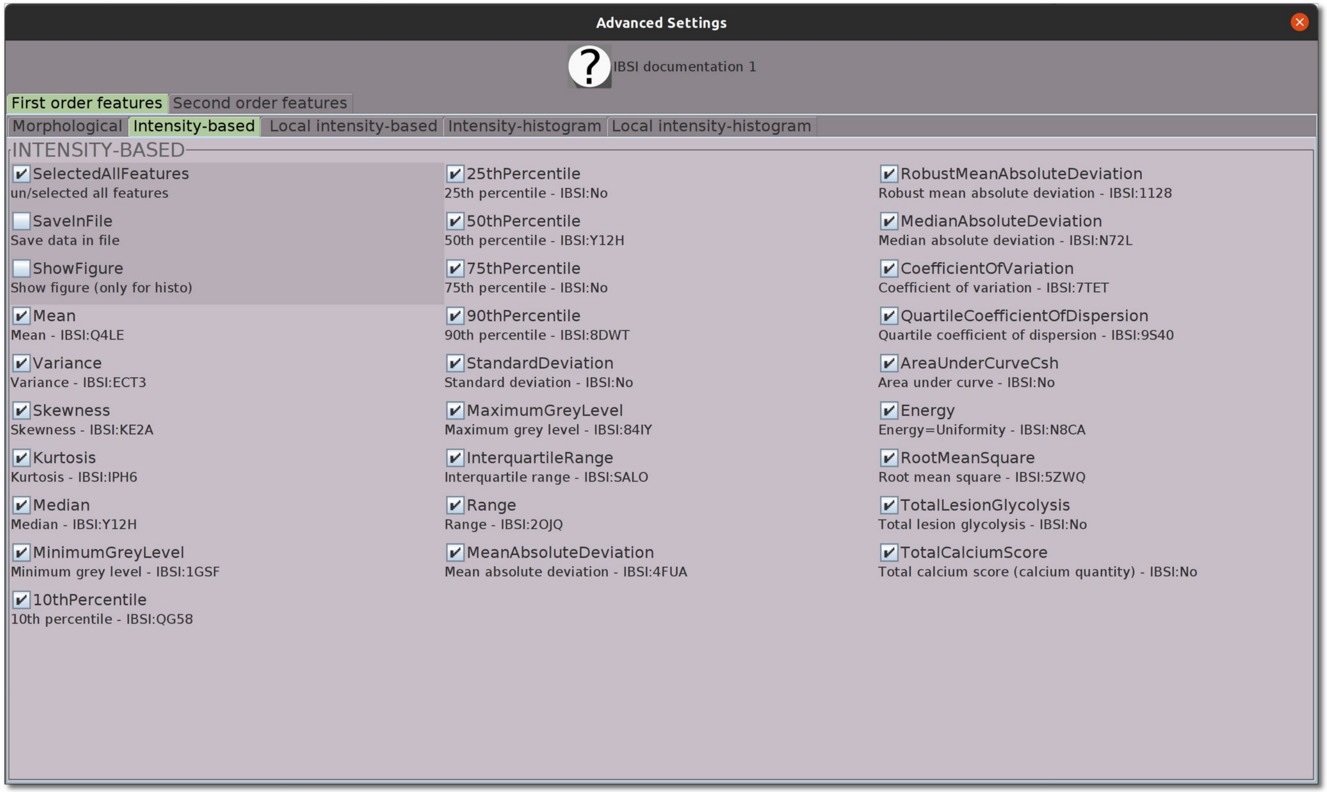
— LIFEx —

Protocol updates

C. Nioche

Texture protocol:

- new Advanced Settings (simplified version)



INTENSITY-BASED

☑ SelectedAllFeatures
un/selected all features

☐ SaveInFile
Save data in file

☐ ShowFigure
Show figure (only for histo)

☑ Mean
Mean - IBSI:Q4LE

☑ Variance
Variance - IBSI:ECT3

☑ Skewness
Skewness - IBSI:KE2A

☑ Kurtosis
Kurtosis - IBSI:IPH6

☑ Median
Median - IBSI:Y12H

☑ MinimumGreyLevel
Minimum grey level - IBSI:1GSF

☑ 10thPercentile
10th percentile - IBSI:QG58

☑ 25thPercentile
25th percentile - IBSI:No

☑ 50thPercentile
50th percentile - IBSI:Y12H

☑ 75thPercentile
75th percentile - IBSI:No

☑ 90thPercentile
90th percentile - IBSI:8DWT

☑ StandardDeviation
Standard deviation - IBSI:No

☑ MaximumGreyLevel
Maximum grey level - IBSI:84IY

☑ InterquartileRange
Interquartile range - IBSI:SALO

☑ Range
Range - IBSI:2OJQ

☑ MeanAbsoluteDeviation
Mean absolute deviation - IBSI:4FUA

☑ RobustMeanAbsoluteDeviation
Robust mean absolute deviation - IBSI:1128

☑ MedianAbsoluteDeviation
Median absolute deviation - IBSI:N72L

☑ CoefficientOfVariation
Coefficient of variation - IBSI:7TET

☑ QuartileCoefficientOfDispersion
Quartile coefficient of dispersion - IBSI:9S40

☑ AreaUnderCurveCsh
Area under curve - IBSI:No

☑ Energy
Energy=Uniformity - IBSI:N8CA

☑ RootMeanSquare
Root mean square - IBSI:5ZWQ

☑ TotalLesionGlycolysis
Total lesion glycolysis - IBSI:No

☑ TotalCalciumScore
Total calcium score (calcium quantity) - IBSI:No

Protocol updates

C. Nioche

Texture protocol:

- reduced processing time of GLCM map → time / 20
- reduced time processing for RIM features → time / 50

Changed namming :

Added IBSI code on feature : example IBSI_Q4LE

- GLCM_EntropyLog → GLCM_JointEntropyLog
- CONVENTIONAL/DISCRETIZED_meanValue → CONVENTIONAL/DISCRETIZED_MeanIntensity(IBSI_Q4LE, ...)
- CONVENTIONAL/DISCRETIZED_stdValue → CONVENTIONAL/DISCRETIZED_IntensityStandardDeviation(IBSI_No)
- CONVENTIONAL/DISCRETIZED_Skewness → CONVENTIONAL/DISCRETIZED_IntensitySkewness(IBSI_KE2A, ...)
- CONVENTIONAL/DISCRETIZED_minValue → CONVENTIONAL/DISCRETIZED_MinimumIntensity(IBSI_1GSF, ...)
- CONVENTIONAL/DISCRETIZED_maxValue → CONVENTIONAL/DISCRETIZED_MaximumIntensity(IBSI_84IY, ...)
- CONVENTIONAL/DISCRETIZED_excessKurtosis → CONVENTIONAL/DISCRETIZED_ExcessIntensityKurtosis(IBSI_No)
- CONVENTIONAL/DISCRETIZED_Kurtosis → CONVENTIONAL/DISCRETIZED_IntensityKurtosis(IBSI_IPH6, ...)
- SHAPE_Volume_mL → MORPHOLOGICAL_ApproximateVolume(IBSI_YEKZ)
- SHAPE_* → MORPHOLOGICAL_*
- NGLDM_* → NGTDM_*
- GLZLM_* become GLSZM_*
- GLZLM_ZLNU → GLSZM_ZSNU(IBSI_4JP3)
- GLCM_Energy → GLCM_AngularSecondMoment(IBSI_8ZQL)
- GLCM_Homogeneity → GLCM_InverseDifferenceMoment(IBSI_WF0Z)
- See News on web to learn more

Added features :

- GLCM_JointMaximum(IBSI_GYBY)
- GLCM_JointAverage(IBSI_60VM)
- GLCM_JointVariance(IBSI_UR99)
- MORPHOLOGICAL_surfaceToVolumeRatio(IBSI_2PR5)
- MORPHOLOGICAL_Compactness1(IBSI_SKGS)
- MORPHOLOGICAL_Compactness2(IBSI_BQWJ)
- MORPHOLOGICAL_SphericalDisproportion(IBSI_KRCK)
- See News on web to learn more

Protocol updates

C. Nioche

Script of texture:

- added line : LIFEx.check=true||false
- added line : LIFEx.cluster=true||false

LIFEx.cluster=true

> clusters are not searched (avalaible only is chek=true)

LIFEx.check=true
> Only theses features are calculated (very quick):

INFO_PatientName
INFO_PatientID
INFO_ProcessDateOfTexture
INFO_SeriesDate
INFO_Series
INFO_ActualFrameDuration
INFO_NameOfRoi
INFO_TimePosition
INFO_zLocation

CONVENTIONAL_min
CONVENTIONAL_mean
CONVENTIONAL_std
CONVENTIONAL_max
SHAPE_Volume(mL)
SHAPE_Volume(vx)

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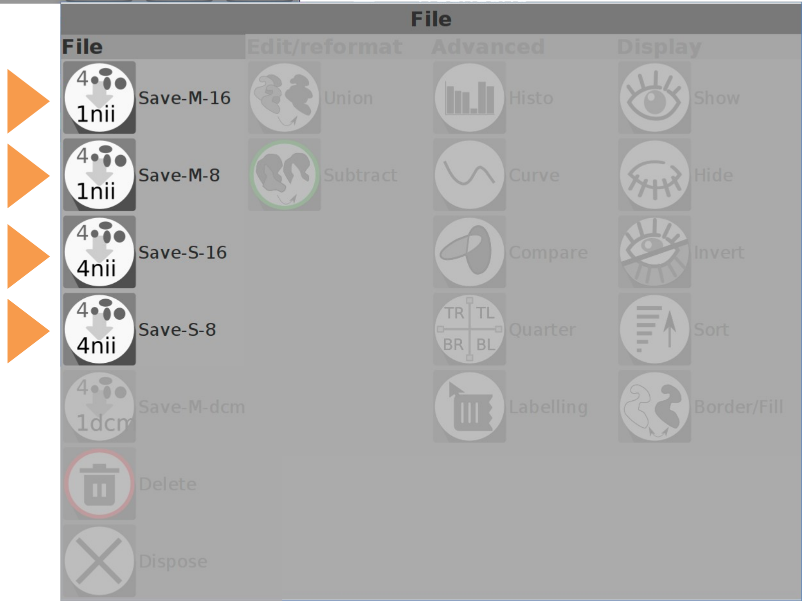
ROI updates

C. Nioche

ROI:

- added: uint8 format on nifti saved ROI
- changed : naming of
  - SaveAllInAll into Save-S (separate files)
  - SaveAllInOne into Save-M



M	Merge
S	Separate (or single)
8	uint8
16	uint16
Save-M-8	Merge all ROIs in a single file [uint8] (=n ROI -> 1 file)
Save-M-16	Merge all ROIs in a single file [uint16] (=n ROI -> 1 file)
Save-S-8	Separate all ROIs in many files [uint8] (=1 ROI / file)
Save-S-16	Separate all ROIs in many files [uint16] (=1 ROI / file)

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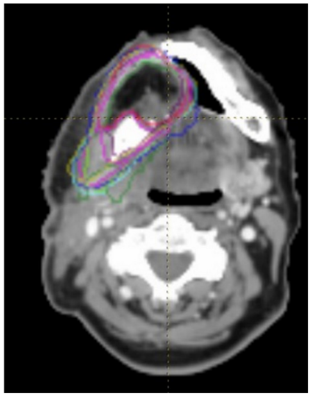
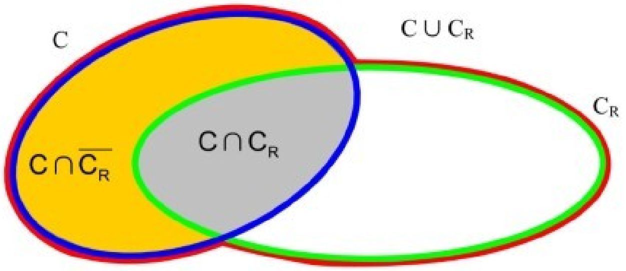
ROI updates

C. Nioche

ROI compare tool (C vs C_R):

- C intersection with C_R
- C union with C_R
- C intersection not C_R
- Volume Ratio C / C_R
- Common Delineated Volume = fraction of C_R overlapped by C
- Additional Delineated Volume = fraction of C not overlapping with C_R
- DICE Similarity Coefficient DSC
- Overlap Index
- Hausdorff distance





C_R: Reference Contour
C: Contour to compare

Volume Ratio	$VR = C/C_R$	Optimum: **1**
Common Delineated Volume	$CDV = (C \cap C_R)/C_R$	Optimum: **100%**
Additional Delineated Volume	$ADV = (C \cap \overline{C_R})/C$	Optimum: **0%**
Kappa Index	$KI = 2 \times (C \cap C_R)/(C + C_R)$	Optimum: **1**
Overlap Index	$OV = (C \cap C_R)/(C \cup C_R)$	Optimum: **1**

LIFEx is still evolving

Other functionalities are being added every week.
Stay tuned !
We hope you go on enjoying LIFEx !

LIFEx is free of charge.

> **Please help us to keep it free** by always quoting the LIFEx reference: (see below)

> Please note that the correct reference to be cited is:
> C Nioche, F Orlhac, S Boughdad, S Reuzé, J Goya-Outi, C Robert, C Pellot-Barakat, M Soussan, F Frouin, and I Buvat. LIFEx: a freeware for radiomic feature calculation in multimodality imaging to accelerate advances in the characterization of tumor heterogeneity. Cancer Research 2018; 78(16):4786-4789